FINAL DRAINAGE REPORT
FOR
TAMLIN ROAD RV & BOAT STORAGE

Prepared For:
C&M Properties, LLC
12748 Barossa Valley Road
Colorado Springs, CO 80921

July 2020
Project No. 2513400

Prepared By:
JR Engineering, LLC
5475 Tech Center Drive, Suite 235
Colorado Springs, CO 80919
719-593-2593

PCD FILE NO.: PPR1945

FINAL DRAINAGE REPORT FOR
TAMLIN ROAD RV & BOAT STORAGE

ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

Mike Bramlett, Colorado P.E. # 32314
For and On Behalf of JR Engineering, LLC

COLORADO LICENSED MIKE BRAMLETT MB 32314 8/14/20 PROFESSIONAL ENGINEER

8/14/20
Date

DEVELOPER'S STATEMENT:

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: C&M Properties, LLC

By: Peter Carroll ~~Edward McDonald~~

Title: Manager
Address: 12748 Barossa Valley Road
Colorado Springs, CO 80921

EL PASO COUNTY

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volumes 1 and 2 and Engineering Criteria Manual, as amended.

APPROVED
Engineering Department
09/09/2020 4:56:20 PM
dsdnijkamp
EPC Planning & Community Development Department

Jennifer Irvine, P.E.
County Engineer/ ECM Administrator

Conditions:

Table of Contents

APPENDIX

PURPOSE

This document is the Final Drainage report for Tamlin Road Storage Yard. The purpose of this report is to:

1. Identify on-site and off-site drainage patterns.
2. Recommend storm water facilities to collect and convey storm runoff from the proposed development to appropriate discharge and/or detention locations.
3. Recommend water quality and detention facilities to control discharge release rates to below historic.
4. Demonstrate compliance with surrounding major drainage basin planning studies, master development drainage plans and flood insurance studies.

GENERAL SITE DESCRIPTION

LOCATION

Tamlin Road Storage Yard, known as 'the site' from herein, is currently vacant land located in a portion of Section 20, Township 13 South, Range 65 West of the Sixth Principal Meridian in unincorporated El Paso County, Colorado. The site is located northeast of the Tamlin Road and Marksheffel Road intersection. The site is bound by Tamlin Road to the west and north, vacant land owned by Norwood to the east and south. Stetson Hills Filing No. 3 and 4 is located adjacent to the site on the west side of Marksheffel Road. A vicinity map has been presented in Appendix A.

Sand Creek East Fork tributary is located approximately ¼ mile east of the site. The ultimate outfall of this drainageway is Fountain Creek. However, there are no existing stormwater facilities located on site.

DESCRIPTION OF PROPERTY

The site is approximately 16.5 acres and is covered with sparse trees and native vegetation. There are no existing structures on the site. An existing dirt road proceeds southeast from Tamlin Road through the site to service an existing water tank, located south of the site. There is a ridge that divides the drainage on the site. Roughly 6.5 acres drains southwest with slopes between 3-10% while the remaining 10 acres drains east with slopes up to 8%. In the developed condition, the site will be asphalt drive aisles, parking stalls and a single trash enclosure.

The site is comprised solely of Truckton sandy loam, which is classified as a Type A soil by the NRCS. Group A soils exhibit a high infiltration rate when thoroughly wet and consist chiefly of deep, well drained to excessively drained gravelly sands. These soils have a high rate of water transmission. A NRCS soil survey map is presented in Appendix A.

There are no known irrigation facilities located on the project site. An existing water line (size unknown) runs north-south through the site in a 30' utility easement. Additionally, three gas mains (size unknown) cross the site. Two of the existing gas lines are parallel to the water main within two separate 50' easements. The third gas line runs parallel to Tamlin in a dedicated 50' easement. All existing utilities will remain and no grading will occur within the limits of the easements.

EXISTING DRAINAGE CONDITIONS

MAJOR BASIN DESCRIPTIONS

The site lies within the West Tributary Sand Creek regional sub basin within the Sand Creek Major Drainage Basin. The "*Sand Creek Drainage Basin Planning Study*" prepared by Kiowa Engineering revised in March 1996, evaluated the Sand Creek Major Drainage Basin, the existing facilities therein and provided recommendations for future development. A map of the Sand Creek regional sub basins is presented in Appendix B.

The Sand Creek Basin covers approximately 54 square miles in unincorporated El Paso County and Colorado Springs, CO. The undeveloped portions of the basin are typified by rolling range land with fair vegetative cover associated with semi-arid climates. The headwaters of the basin are in The Black Forest and general topography trends south to southwest towards its ultimate outfall into Fountain Creek. Per the *Sand Creek DBPS,* the Sand Creek East Fork Subtributary runs outside the western boundary of the site. This drainageway begins at the confluence with the mainstem of East Fork Sand Creek and runs north to Barnes Road.

Based on the FEMA FIRM Map number 08041C0543G and 08041C0545G, the site does not fall within a FEMA defined floodplain and is classified as Zone X, which are areas determined to be outside the 0.2% annual chance floodplain. FIRM maps of the site and surrounding areas have been presented in Appendix A.

EXISTING SUB-BASIN DRAINAGE

Existing drainage patterns are split on the site by a ridge running north-south. The eastern portion of the site drains across undeveloped land to Sand Creek East Fork Subtributary. The western portion of the site drains across Tamlin Road and Marksheffel road into Eastview Estates Filing No. 3 storm sewer. An existing drainage analysis and map are presented in Appendix C and F, respectively.

PROPOSED DRAINAGE CONDITIONS

PROPOSED SUB-BASIN DRAINAGE

In general, runoff generated from the site will be collected and conveyed to a full spectrum water quality and detention pond, Pond A. All proposed parking and drive aisles will be constructed of crushed asphalt. However, there is a possibility of the owner paving the drive aisles and parking stalls with asphalt in the future. Therefore, all calculations (hydrologic and hydraulic) have been performed per the future asphalt condition. The west side of the parcel was not delineated as a basin since the land will not be developed and will continue to follow historic drainage patterns.

The proposed basin descriptions are as follows:

Basins Tributary to Proposed Full Spectrum Detention and Water Quality Pond A

Basin A1 consists of approximately 0.09 acres of existing Tamlin Road pavement and undeveloped areas paralleling Tamlin Road. Runoff from these areas will sheet flow southeast to Design Point (DP) #1. From here, Basin A1 flows (Q_5 = 0.2 cfs and Q_{100} = 0.4 cfs) to DP#2 prior to being captured and detained in Full Spectrum Detention and Water Quality Pond A. This is the only offsite flow that will be captured in the proposed pond.

Basin A2 consists of approximately 4.05 acres of crushed asphalt drives, crushed asphalt parking stalls and landscaped areas. Runoff from this basin (Q_5 = 13.5 cfs and Q_{100} = 26.0 cfs) sheet flows southeast to DP #2 before being captured and detained in Full Spectrum Detention and Water Quality Pond A.

Basin A3 consists of approximately 4.72 acres of crushed asphalt drives, crushed asphalt parking stalls and landscaped areas. Runoff from this basin (Q_5 = 16.0 cfs and Q_{100} = 30.0 cfs) sheet flows northeast to DP #2 before being captured in Full Spectrum Detention and Water Quality Pond A.

Basin A4 consists of approximately 0.70 acres and consists of Full Spectrum Detention and Water Quality Pond A. Runoff from this basin (Q_5 = 0.3 cfs and Q_{100} = 1.9 cfs) will be captured within the pond. Full Spectrum Detention and Water Quality Pond A will release at equal to or less than historic rates and is detailed later in this report.

Basins Not Tributary to Proposed Full Spectrum Detention and Water Quality Pond A (Undetained Release Offsite)

Basin E is an existing offsite basin tributary to the site and is described by Park Engineering in the "Drainage Technical Memo – Trojan Storage 246-67" dated 7/5/16. Refer to the memo and corresponding plan in Appendix B. Basin E consists of approximately 5.55 acres of existing storage buildings and asphalt driveways. Runoff from this basin is routed to an existing water quality /

detention pond located on the northwest side of Tamlin Road. Refer to the drainage maps in Appendix F for the pond location in relation to the site. The discharge from this pond (Q_{100} = 5.6 cfs (the memo does not give the 5-year flow)) enters the existing ditch on the northwest side of Tamlin Road at DP E1. The existing ditch is in a sump condition. Stormwater that overtops Tamlin Road will enter Basin A5 and will be bypassed around the site via proposed swales and a culvert to a proposed low-tailwater basin at DP#4 (Q_{100} = 11.0 cfs). The low-tailwater basin will act as an energy dissipater and release these existing flows across gradually sloping undeveloped land as sheet flow towards the Sand Creek East Fork Subtributary approximately 1,000 feet east.

Basin A5 consists of approximately 1.84 acres of existing Tamlin Road asphalt and undeveloped land. Runoff from this basin (Q_5 = 1.2 cfs and Q_{100} = 5.5 cfs) will follow historic patterns and sheet flow southeast offsite along the property line or enter the proposed swale and discharge offsite at the proposed low-tailwater basin at DP#4. Per Section I.7.1.B.7 of the ECM – Stormwater Quality Policy and Procedures, the County may exclude sites with land disturbance to undeveloped land that will remain undeveloped from the WQCV standard. Therefore, Basin A5 will not be detained in Full Spectrum Detention and Water Quality Pond A.

Basin A6 consists of approximately 0.22 acres of landscape area and undeveloped land. Runoff from this basin (Q_5 = 0.1 cfs and Q_{100} = 0.7 cfs) will follow historic patterns and sheet flow east offsite at DP#5. Per Section I.7.1.B.7 of the ECM – Stormwater Quality Policy and Procedures, the County may exclude sites with land disturbance to undeveloped land that will remain undeveloped from the WQCV standard. Therefore, Basin A6 will not be detained in Full Spectrum Detention and Water Quality Pond A.

Basin A7 consists of approximately 0.39 acres of landscape area and undeveloped land. Runoff from this basin (Q_5 = 0.2 cfs and Q_{100} = 1.2 cfs) will follow historic patterns and sheet flow east offsite at DP#6. Per Section I.7.1.B.7 of the ECM – Stormwater Quality Policy and Procedures, the County may exclude sites with land disturbance to undeveloped land that will remain undeveloped from the WQCV standard. Therefore, Basin A7 will not be detained in Full Spectrum Detention and Water Quality Pond A.

Basin A8 consists of approximately 0.40 acres of landscape area and undeveloped land. Runoff from this basin (Q_5 = 0.2 cfs and Q_{100} = 1.2 cfs) will follow historic patterns and sheet flow east offsite at DP#7. Per Section I.7.1.B.7 of the ECM – Stormwater Quality Policy and Procedures, the County may exclude sites with land disturbance to undeveloped land that will remain undeveloped from the WQCV standard. Therefore, Basin A8 will not be detained in Full Spectrum Detention and Water Quality Pond A.

Total runoff released offsite along the eastern property line from Basins A5-A8, Basin E, and the Full Spectrum Detention and Water Quality Pond A at design points 4-7 (Q_{100} = 20.7 cfs) is less than the

historic flow at the property line from Basin EX2 at existing design point 2 (Q_{100} = 21.2 cfs). The existing wide grassed gently-sloped swale that receives the flow along the eastern property line is currently stable. Therefore, the proposed development will not negatively impact the receiving swale.

DEVELOPMENT CRITERIA REFERENCE

Storm Drainage Analysis and Design Criteria for this project were implemented from the El Paso County "Drainage Criteria Manual" (DCM) and the "Urban Storm Drainage Criteria Manual" by Urban Drainage and Flood Control District (USDCM).

HYDROLOGIC CRITERIA

All hydrologic data was obtained from the "El Paso County Drainage Criteria Manual" Volumes 1 and 2, and the "Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual" Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5 year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Table 6-2 of the Colorado Springs Criteria. One hour point rainfall data for the storm events is identified in the chart below. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the DCM. Time of concentrations were developed using equations from DCM. Water quality and detention pond will be sized per the full spectrum method presented in Chapter 13 of the DCM. All runoff calculations and applicable charts and graphs are included in Appendix A.

Table 1 - 1-hr Point Rainfall Data

Storm	Rainfall (in.)
5-year	1.50
100-year	2.52

Rock mulch islands are dispersed throughout the parking areas. Table 6-6 from the El Paso County DCM does not provide a composite percent impervious for rock mulch. The impervious value for gravel, of 80%, does not apply for rock mulch since the gravel impervious value is based upon compacted gravel used for roads. The rock mulch utilized on site will not be compacted and will have undisturbed soil underneath allowing percolation. Table 6-3 from Volume 1 of Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual proposes an impervious value of 40% for packed gravel. JR Engineering is proposing to use a value of 20% for rock mulch areas due to the void space and undisturbed area that increase perviousness.

HYDRAULIC CRITERIA

The Rational Method and USDCM's SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site, and the UDFCD UD-Detention v3.07 spreadsheet was

utilized for sizing the water quality and detention pond as well as outlet structure. Manning's equation was used to size the proposed drainage swales in this report.

DRAINAGE FACILITY DESIGN

FOUR STEP PROCESS TO MINIMIZE ADVERSE IMPACTS OF URBANIZATION

In accordance with the Colorado Springs Drainage Criteria Manual, Volume 2 this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

Step 1 – Reducing Runoff: The Tamlin Road Storage Yard consists of crushed asphalt drive aisles and parking spaces with lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. The IRF worksheet can be found in Appendix C.

Step 2 – Treating the Water Quality Capture Volume: Water Quality treatment for this site is provided in one onsite full spectrum water quality and detention pond. Runoff from the site will sheet flow over the proposed crushed asphalt parking area to the detention pond.

Step 3 – Stabilizing Drainageways: There are no major drainageways on the site that need to be stabilized. No drainage fees are due with this site development plan and final drainage report. If the site were to be platted in the future, drainage fees will be paid at that time in order to help fund major drainage improvements per the "*Sand Creek Drainage Basin Planning Study*". These improvements help stabilize major offsite drainage ways.

Step 4 – Implementing Long Term Source Controls: BMP's will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. Site specific temporary source control BMPs that will be implemented include, but are not limited to, silt fencing placed around downstream areas of disturbance, construction vehicle tracking pads at the entrances, designated vehicle fueling areas, covered storage areas, spill containment and control, etc. The permanent erosion control BMP's include crushed asphalt drives and parking.

WATER QUALITY

Runoff from Basins A1-A4 will be conveyed to Full Spectrum Water Quality and Detention Pond A, located along the site's eastern boundary. All proposed parking and drive aisles will be constructed of crushed asphalt. However, there is a possibility of the owner paving the drive aisles and parking stalls with asphalt in the future. Therefore, all water quality and detention calculations are per the asphalt condition.

Pond A has a total of 9.56 tributary acres for total detention basin volume of 1.262 ac-ft. The pond was designed to accommodate only the flows from Basins A1-A4, not the flow from the existing offsite Basin E, which will bypass the pond. Pond A utilizes a full spectrum outlet structure to detain the WQCV for a 42-hr period, the EURV for a 79-hour period and the 100-yr volume for 86-hr period. Per the UD-Detention spreadsheet found in Appendix E, the outlet structure releases at adequately functions for both Water Quality and EURV and releases at historic rates for the 25, 50 and 100-year storm. The 5-year and 10-year storm release at 0.2 cfs and 0.1 cfs above the historic rates, respectively. The author attempted to further restrict the 5 and 10-year release rate to historic through a variety of techniques but was unable to accomplish the reduction without increasing a second issue of excessive drain time. Please note the EURV release (0.3 cfs) is equal to the historic 10 year release rate (0.3 cfs).

Pond A will discharge into a proposed energy dissipater (low tailwater basin) located along the eastern property line. An existing riprap pad on the adjacent property was placed by others in the past. The pad shows no adverse effects from past storms and further helps disperse the flow. From here, stormwater will maintain historic drainage patterns and release these existing flows into a broad, well vegetated, gently sloping natural swale towards the Sand Creek East Fork Subtributary approximately 1,000 feet east. The downstream swale was analyzed in the 100-year condition assuming that all design points that release offsite (4, 5, 6 and 7), as well as Pond A, have found their way to the swale. The swale was found to have non-erosive velocities of under 2 feet per second. Therefore, the natural swale is adequate and does not require any protection or improvements. Refer to a channel report in Appendix D.

EROSION CONTROL PLAN

The El Paso County Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate to be submitted with the Final Drainage Report. We respectfully request that the Erosion Control Plan and Cost Estimate be submitted in conjunction with the grading and erosion control plan and construction assurances posted prior to obtaining a grading permit.

OPERATION & MAINTENANCE

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. The property owner shall be responsible for the inspection, maintenance, rehabilitation and repair of stormwater and erosion control facilities located on the property unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. Access is provided from onsite facilities. An Inspection and Maintenance Manual will accompany the Final Drainage Report submittal package.

FLOODPLAIN STATEMENT

Based on the FEMA FIRM Map number 08041C0543G and 08041C0545G, the site does not fall within a FEMA defined floodplain and is classified as Zone X, which are areas determined to be outside the 0.2% annual chance floodplain. FIRM maps of the site and surrounding areas have been presented in Appendix A.

DRAINAGE AND BRIDGE FEES

The site lies within the Sand Creek Drainage Basin. See Table 2 below for required drainage basin fees. Per El Paso County processes, drainage fees are due at the time of platting. This development is not proposed to be platted and the fees shown in Table 2 below are for informational purposes only. The fees are based on a paved site and have not taken into consideration pond construction credits for the proposed detention pond.

Table 2 – Basin Fees

Tamlin Road Storage Yard Drainage Basin Fees					
Total Area	Site% Imperviousness	Impervious Acres	Drainage Fee/Impervious Acre	Bridge Fee/Impervious Acre	Total Fee
12.41	71.70%	8.9	$18,940	$5,559	$218,041.10

CONSTRUCTION COST OPINION

See Table 3 below for cost opinion of private storm sewer infrastructure.

Table 3 – Construction Cost Opinion

Private Drainage Facilities				
Item	Quantity	Unit	Unit Price	Extended Cost
18" RCP	92	LF	$ 45.00	$ 4,140.00
18" FES	3	EA	$ 1,500.00	$ 4,500.00
SPILLWAY (TYPE M RIPRAP)	64	CY	$ 125.00	$ 8,000.00
RIPRAP PADS & TAIL WATER BASIN (TYPE M & L RIPRAP)	90	CY	$ 125.00	$ 11,250.00
AGG. BASE COURSE MAINT. ROAD	117	SY	$ 45.00	$ 5,265.00
FULL SPECTURM OUTLET STRUCTURE	1	LS	$ 15,000.00	$ 15,000.00
			Sub-Total	$ 48,155.00
	10% Eng. And Contingency			$ 4,815.50
			Grand Total	$ 52,970.50

SUMMARY

The proposed Tamlin Road RV Storage drainage improvements include storm sewer, a Full Spectrum Detention and Water Quality Pond, and an engineered outfall. The proposed development will not adversely affect the offsite major drainageways or surrounding developments. This report is in conformance with the latest El Paso County Storm Drainage Criteria requirements for this site.

REFERENCES

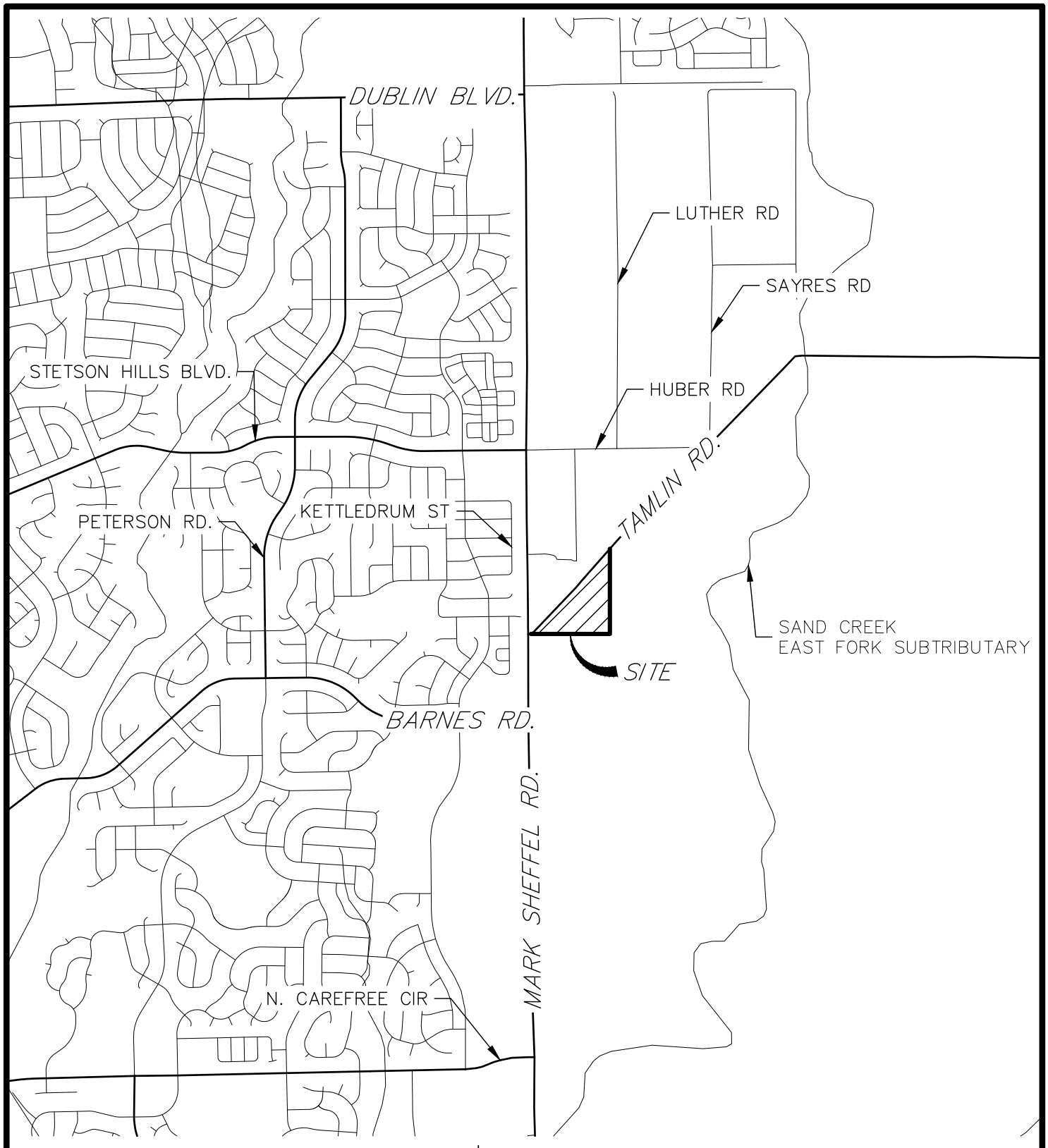
1. El Paso County Drainage Criteria Manual (Volumes I & II), El Paso County CO, Colorado, Updated May, 2014.

2. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), Urban Drainage and Flood Control District, June 2001.

3. "Hydrologic Group Rating for El Paso County Area, Colorado", USDA-Natural Resources Conservation Service, National Cooperative Soil Survey. Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov. [June 14, 2019]

4. "Sand Creek Drainage Basin Planning Study Final Design Report", Kiowa Engineering Corporation, March 1996.

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



N

2000 1000 0 2000

ORIGINAL SCALE: 1" = 2000'

VICINITY MAP
TAMLIN ROAD STORAGE YARD
2513400
06/14/19
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com


104° 40' 58" W
104° 40' 39" W
527510
527580
527650
527720
527790
527860
527930
38° 54' 32" N
38° 54' 13" N
4306710
4306640
4306570
4306500
4306430
4306360
4306290
4306220
4306150
Tamlin Rd
97
Soil Map may not be valid at this scale.
Map Scale: 1:2,840 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 40 80 160 240
Feet
0 100 200 400 600
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 16, Sep 10, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 15, 2011—Aug 17, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
97	Truckton sandy loam, 3 to 9 percent slopes	A	17.9	100.0%
Totals for Area of Interest			**17.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

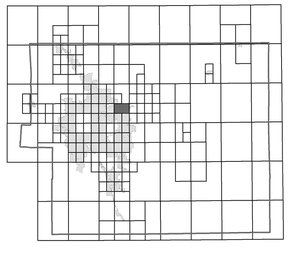
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

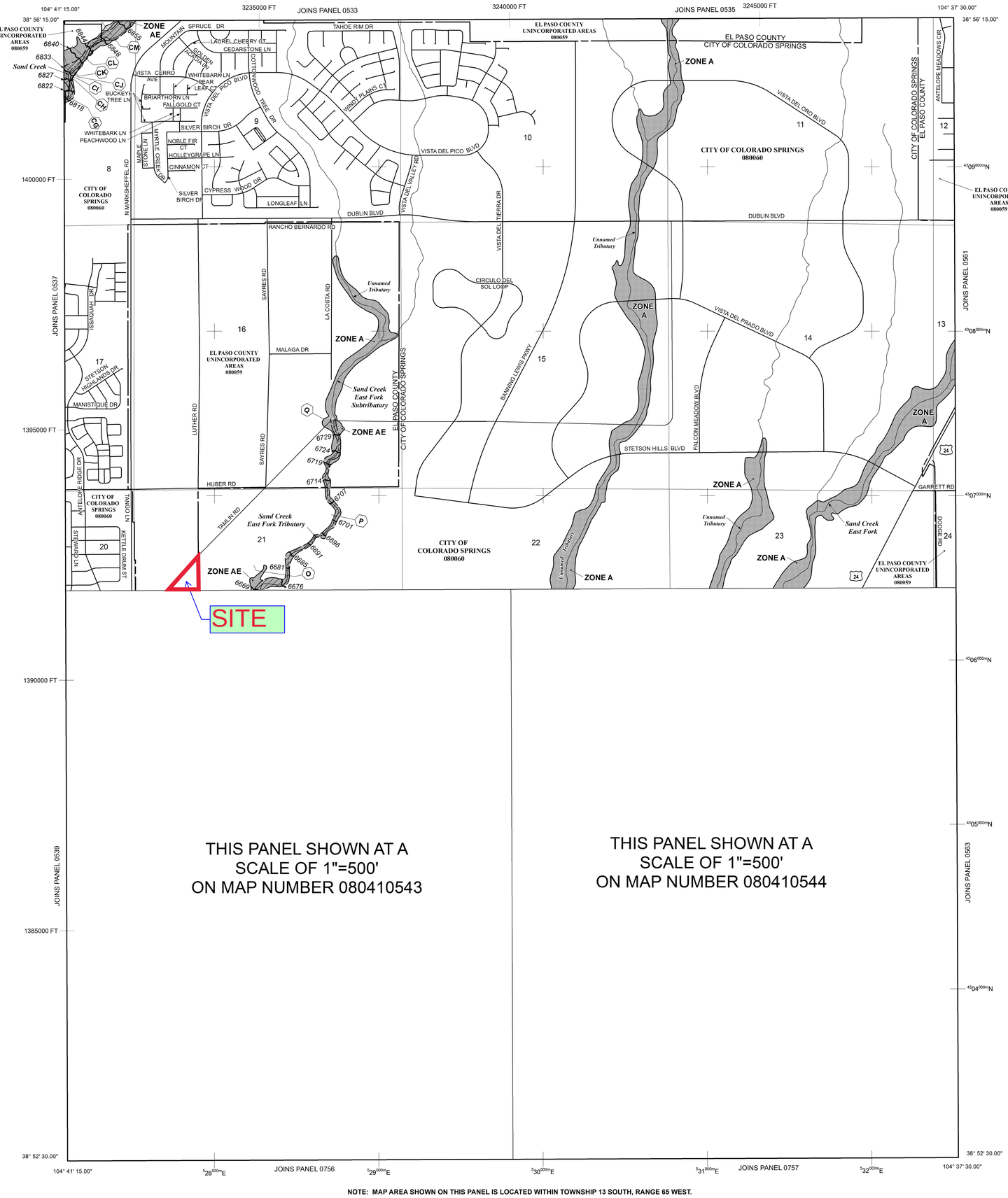
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary
Floodway boundary
Zone D Boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A — Cross section line
23 — 23 — Transect line
97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

PANEL 0545G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 545 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0545	G
EL PASO COUNTY	080059	0545	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 08041C0545G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

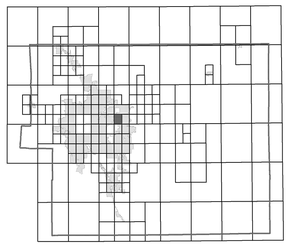
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

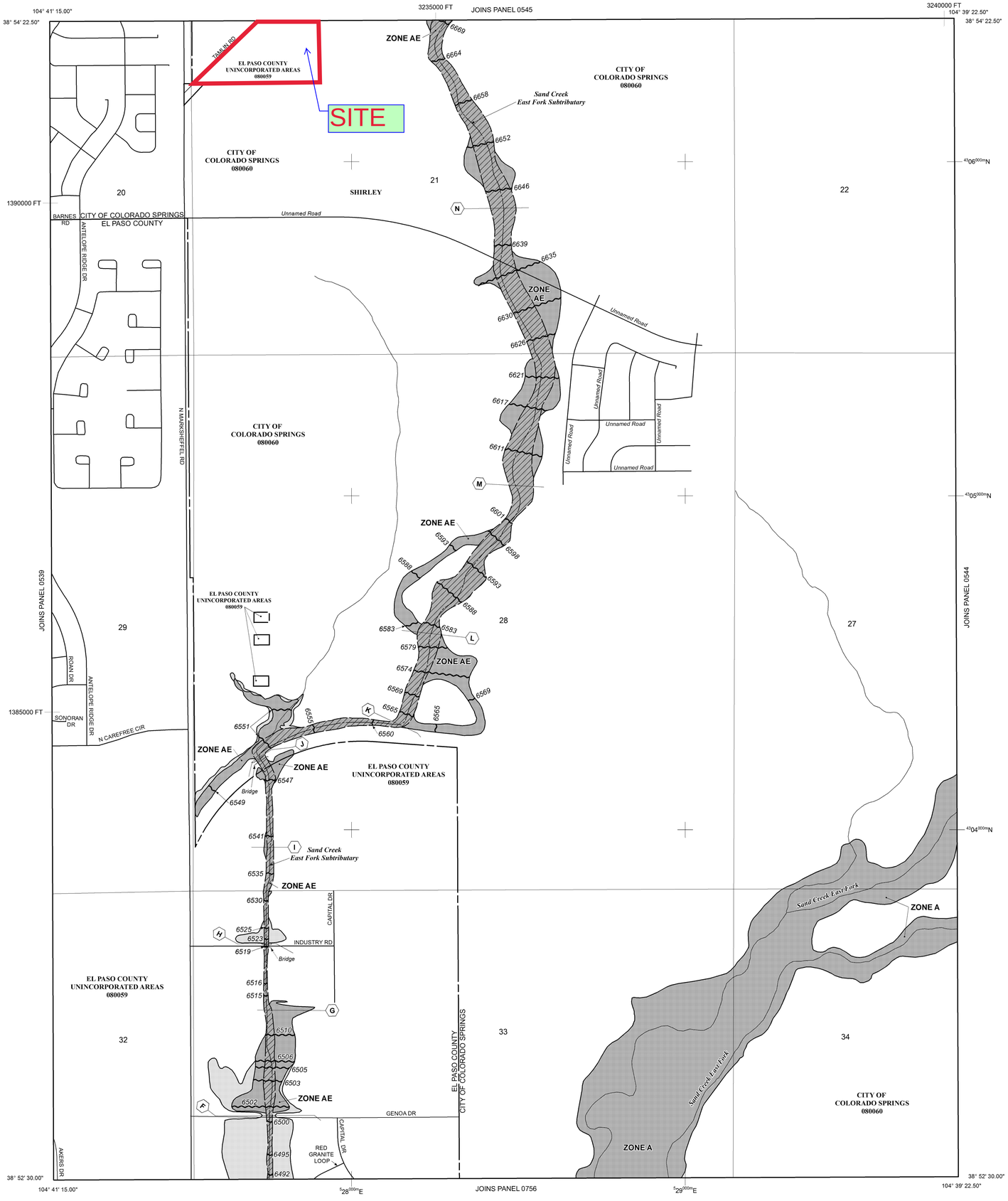
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A — Cross section line
- 23 — 23 — Transect line
- 97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0543G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 543 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0543	G
EL PASO COUNTY	080059	0543	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0543G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette

FEMA

0 250 500 1,000 1,500 2,000 Feet 1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/14/2019 at 10:33:46 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Appendix B
Reference Material

El Paso County Drainage Basin Fees

Resolution No. 18-470

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2019 Drainage Fee (per Impervious Acre)	2019 Bridge Fee (per Impervious Acre)
Drainage Basins with DBPS's:					
CHMS0200	Chico Creek	2013	Haegler Ranch	$10,324	$1,524
CHWS1200	Chico Creek	2001	Bennett Ranch	$11,558	$4,433
CHWS1400	Chico Creek	2013	Falcon	$29,622	$4,069
FOFO2000	Fountain Creek	2001	West Fork Jimmy Camp Creek	$12,564	$3,717
FOFO2600	Fountain Creek	1991*	Big Johnson / Crews Gulch	$18,350	$2,370
FOFO2800	Fountain Creek	1988*	Widefield	$18,350	$0
FOFO2900	Fountain Creek	1988*	Security	$18,350	$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	$18,350	$275
FOFO3100 / FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	$11,192	$0
FOFO3400	Fountain Creek	1984*	Peterson Field	$13,235	$1,004
FOFO3600	Fountain Creek	1991*	Fisher's Canyon	$18,350	$0
FOFO4000	Fountain Creek	1996	Sand Creek	$18,940	$5,559
FOFO4200	Fountain Creek	1977	Spring Creek	$9,517	$0
FOFO4600	Fountain Creek	1984*	Southwest Area	$18,350	$0
FOFO4800	Fountain Creek	1991	Bear Creek	$18,350	$1,004
FOFO5400	Fountain Creek	1977	21st Street	$5,521	$0
FOFO5600	Fountain Creek	1964	19th Street	$3,611	$0
FOFO5800	Fountain Creek	1964	Camp Creek	$2,033	$0
FOMO0400	Monument Creek	1986*	Mesa	$9,598	$0
FOMO1000	Monument Creek	1981	Douglas Creek	$11,540	$255
FOMO1200	Monument Creek	1977	Templeton Gap	$11,847	$275
FOMO1400	Monument Creek	1976	Pope's Bluff	$3,676	$627
FOMO1600	Monument Creek	1976	South Rockrimmon	$4,314	$0
FOMO1800	Monument Creek	1973	North Rockrimmon	$5,521	$0
FOMO2000	Monument Creek	1971	Pulpit Rock	$6,085	$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	$18,350	$1,004
FOMO2400	Monument Creek	1966	Dry Creek	$14,486	$524
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	$8,331	$524
FOMO3700	Monument Creek	1987*	Middle Tributary	$15,312	$0
FOMO3800	Monument Creek	1987*	Monument Branch	$18,350	$0
FOMO4000	Monument Creek	1996	Smith Creek	$7,481	$1,004
FOMO4200	Monument Creek	1989*	Black Forest	$18,350	$500
FOMO5200	Monument Creek	1993*	Dirty Woman Creek	$18,350	$1,004
FOMO5300	Fountain Creek	1993*	Crystal Creek	$18,350	$1,004
Miscellaneous Drainage Basins: [1]					
CHBS0800	Chico Creek		Book Ranch	$17,217	$2,492
CHEC0400	Chico Creek		Upper East Chico	$9,380	$272
CHWS0200	Chico Creek		Telephone Exchange	$10,306	$241
CHWS0400	Chico Creek		Livestock Company	$16,976	$202
CHWS0600	Chico Creek		West Squirrel	$8,849	$3,672
CHWS0800	Chico Creek		Solberg Ranch	$18,350	$0
FOFO1200	Fountain Creek		Crooked Canyon	$5,540	$0
FOFO1400	Fountain Creek		Calhan Reservoir	$4,625	$270
FOFO1600	Fountain Creek		Sand Canyon	$3,342	$0
FOFO2000	Fountain Creek		Jimmy Camp Creek[3]	$18,350	$858
FOFO2200	Fountain Creek		Fort Carson	$14,486	$524
FOFO2700	Fountain Creek		West Little Johnson	$1,209	$0
FOFO3800	Fountain Creek		Stratton	$8,801	$394
FOFO5000	Fountain Creek		Midland	$14,486	$524
FOFO6000	Fountain Creek		Palmer Trail	$14,486	$524
FOFO6800	Fountain Creek		Black Canyon	$14,486	$524
FOMO4600	Monument Creek		Beaver Creek	$10,970	$0
FOMO3000	Monument Creek		Kettle Creek	$9,909	$0
FOMO3400	Monument Creek		Elkhorn	$1,665	$0
FOMO5000	Monument Creek		Monument Rock	$7,953	$0
FOMO5400	Monument Creek		Palmer Lake	$12,717	$0
FOMO5600	Monument Creek		Raspberry Mountain	$4,278	$0
PLPL0200	Monument Creek		Bald Mountain	$9,116	$0
Interim Drainage Basins: [2]					
FOFO1800	Fountain Creek		Little Fountain Creek	$2,346	$0
FOMO4400	Monument Creek		Jackson Creek	$7,263	$0
FOMO4800	Monument Creek		Teachout Creek	$5,044	$758

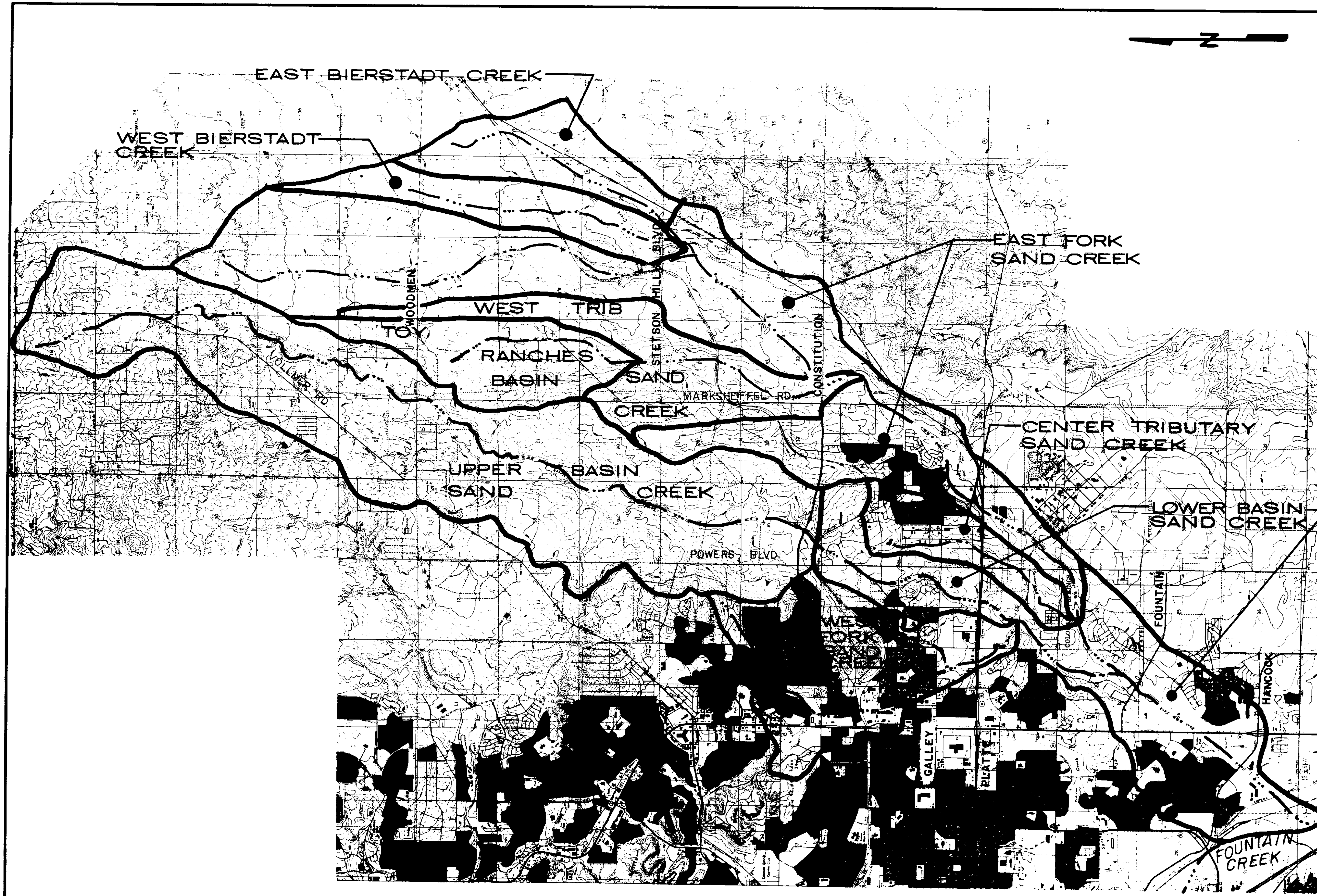
1. The miscellaneous drainage fee previous to September 1999 resolution was the average of all drainage fees for basins with Basin Planning Studies perform

2. Interim Drainage Fees are based upon draft Drainage Basin Planning Studies or the Drainage Basin Identification and Fee Estimation Report. (Best availabl

3. This is an interim fee and will be adjusted when a DBPS is completed. In addition to the Drainage Fee a surety in the amount of $7,285 per impervious acre sh the DBPS results in a fee greater than the current fee. Fees paid in excess of the future revised fee will be reimbursed. See Resolution 06-326 (9/14/06) and Res

EPC Stormwater Management

Jennifer Irvine, P.E.



Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY

REGIONAL SUB-BASINS

Project No	90-04-09
Date:	11/90
Design:	
Drawn:	EAK
Check:	
Revisions:	

FIG. III-1

J·R ENGINEERING
A Westrian Company

PRELIMINARY/FINAL DRAINAGE REPORT FOR EASTVIEW ESTATES FILING NO. 3

January 2005
Revised November 2005

Prepared For:

LENNAR COMMUNITIES COLORADO
7222 Commerce Center Drive, Suite 118
Colorado Springs, CO 80919
(719) 593-8583

Prepared By:

JR ENGINEERING
4310 ArrowsWest Drive
Colorado Springs, CO 80907-3449
(719) 593-2593

Job No. 8965.08

Hills subdivision at the varying grade of 2% - 10%. As reported in the "Preliminary/Final Drainage Report for Eastview Estates Filing No. 2" further area study revealed a 42" CMP located under Marksheffel Road, which deposits flow onto the Eastview Estates Filing No. 3. Investigation has lead to the belief that the offsite basin, approximately 23 acres shown as WW-13, will maintain at historic level, Q_5 = 14.8 cfs and Q_{100} = 36.9 cfs. The anticipated runoff from the 7.27 acre Eastview Estates Filing No. 3 will be directed to Antelope Ridge Drive where it is to be collected along with Eastview Estates Filing No. 2 runoff as the surface and subsurface flows mentioned above.

PROPOSED DRAINAGE CHARACTERISTICS

East Fork Sand Creek Drainage Basin

Planned development for Eastview Estates Filing No. 3 is to construct 7.27 acres of planned single-family residential subdivision zoned R1-6000 DFOZ, located north of Willowind at Stetson Hills Filing No. 4, east of Eastview Estates Filing No. 2, and west of Marksheffel Road. Runoff from this single-family site will be intercepted into the existing storm system located in Antelope Ridge Drive, Eastview Estates Filing No. 2.

Per the "Master Development Drainage Plan for Eastview Estates", runoff from future Marksheffel Road, located to the east of the site, will be considered to comply with the assumptions made within the "Final Drainage Report and Plan for Willowind at Stetson Hills Filing Nos. 1, 2, and 3", which states runoff from future roadway will be conveyed to a planned inlet located within Marksheffel Road and conveyed to the existing 6'x 8' box culvert under Barnes Road, with a carryover conveyed to the low point within Barnes Road approximately 300' west of the Marksheffel intersection. Until this completion of Marksheffel Road, flows will be intercepted at the grated inlet of the Manhole at DP-11C.

Eastview Estates Filing No. 3 Detailed Description

The proposed single-family development is contained within Basins F-1, F-2, F-3, and F-4. These basins are comprised of residential lots and public streets. "Preliminary/Final Drainage Report for Eastview Estates Filing No. 2" previously analyzed runoff flows from this area and

the impact Eastview Estates Filing No. 3 would have on the existing storm sewer and surface flows to off-site developments. Since then, changes in grading and roadway layout have altered the site to the now proposed Basins F-1, F-2, F-3, and F-4.

Basin F-1 is comprised of residential lots and streets. Basin F-1 (4.12 acres, Q_5 = 10.1 cfs, Q_{100} = 21.1 cfs), along with flow-by from the inlet at DP-9 (FB Q_5 = 1.5 cfs, FB Q_{100} = 4.6 cfs) are combined and collected at DP-9B (Q_5 = 8.1 cfs, Q_{100} = 18.3 cfs) by an existing 20' D-10-R at-grade inlet. The flows are routed via an existing 18" RCP storm pipe and combine with SD-2, in the existing 30" RCP storm main within Antelope Ridge Drive at SD-3 (Q_5 = 29.9 cfs, Q_{100} = 59.7 cfs).

Offsite Basin OS-1 (2.98 Acres, Q_5 = 5.8 cfs, Q_{100} = 13.9 cfs) consists of portions of the existing Marksheffel Road and undeveloped land. This flow will be intercepted by a proposed city standard manhole with a Neenah 4342 Grated Inlet. A proposed berm will pond the water at the southern portion of Eastview Estates Filing No. 3. In the case that the inlet becomes clogged and unable to handle all of the flow, or basin WW-13 overtops Marksheffel Road, a spillway will be graded to convey excess flows onto the Steward Lane Cul-de-sac. The flows would then be carried in the street as surface flows. Basin OS-1 will contribute flows to the proposed system until Marksheffel Road is completed to its fully developed width. Upon this completion flows will be entirely contained within the basin WW-A6 (Discussed in the Final Drainage Report and Plan for Willowind at Stetson Hills Filing Nos. 1, 2, and 3), providing reduced runoff into the proposed system.

Offsite Basin WW-13 (23.42 Acres, Q_5 = 14.8 cfs, Q_{100} = 36.9 cfs) currently conveys historic flows that are collected in an existing 42" CMP under Marksheffel Road (Preliminary/Final Drainage Report for Eastview Estates Filing No. 2). This flow will be intercepted by a proposed city standard Type I manhole with grated inlet. This inlet also collects the flow prior to completion of Marksheffel Road in Basin OS-1 (2.98 Acres, Q_5 = 5.8 cfs, Q_{100} = 13.9 cfs). The flows are then routed via a proposed 30" RCP westerly where they combine with SD-3 (Q_5 = 29.9 cfs, Q_{100} = 59.7 cfs) and SD-8 (Q_5 = 10 cfs, Q_{100} = 18 cfs, Preliminary/Final Drainage Report for Eastview Estates Filing No. 2) at SD-4 (Q_5 = 52.3 cfs, Q_{100} = 109.9 cfs).

EASTVIEW FILING NO. 3

CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO

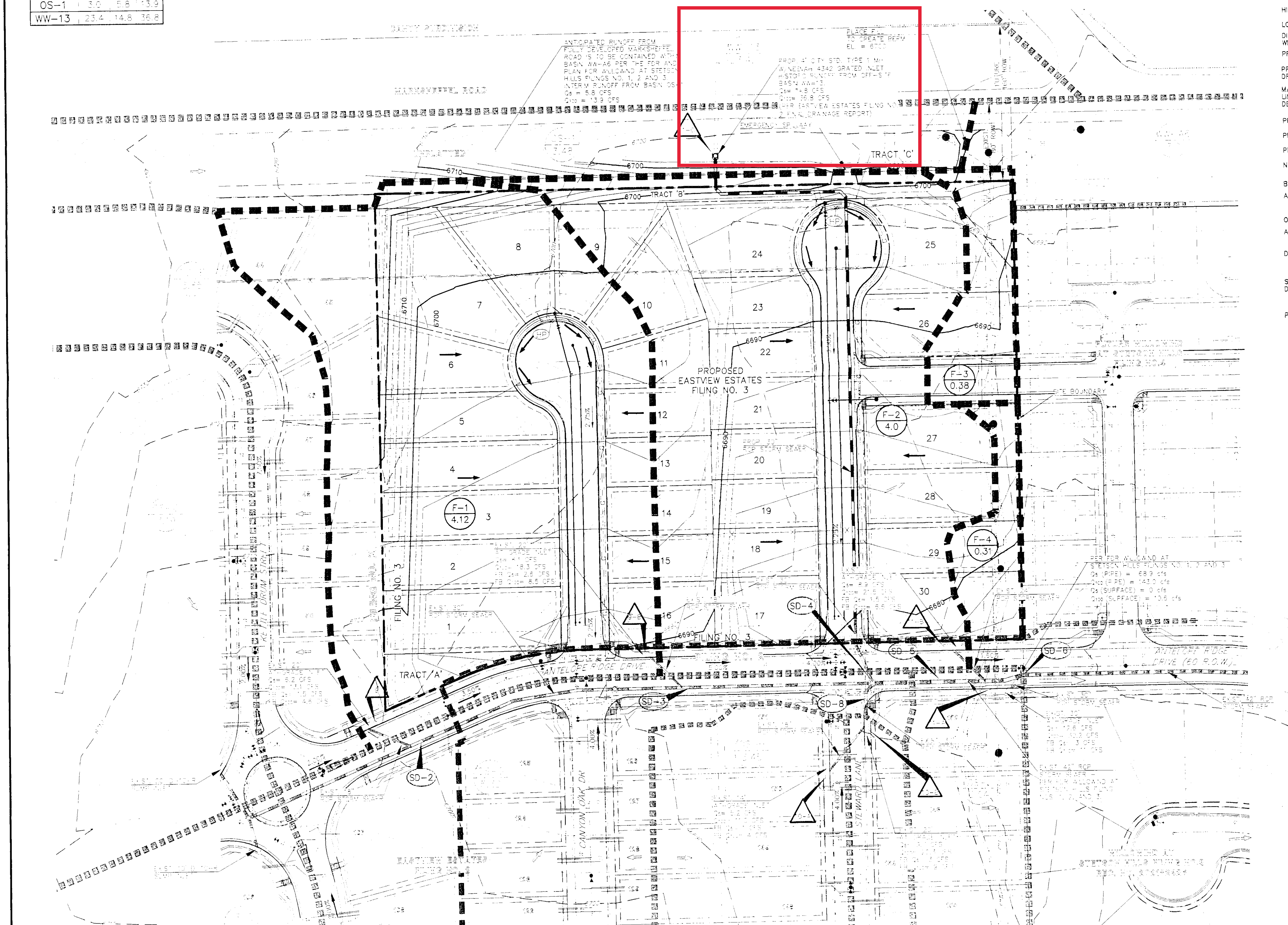
DRAINAGE PLAN

JANUARY 2005

BASIN	AREA (ACRES)	Q_5 (CFS)	Q_{100} (CFS)
OS-C	7.2	14.2	29.7
OS-D	5.3	8.9	18.6
OS-E	3.9	6.3	13.1
OS-G	5.3	10.4	21.8
OS-H	3.5	5.2	11.0
OS-I	3.0	5.5	11.5
OS-J1	1.3	2.2	4.5
F-1	4.1	10.1	21.1
F-2	4.0	12.0	25.0
F-3	0.4	1.0	2.2
F-4	0.3	0.8	1.7
OS-1	3.0	5.8	13.9
WW-13	23.4	14.8	36.8

DESIGN POINTS	Q_5 (CFS)	Q_{100} (CFS)
DP-9	6.2	13.1
DP-9-B	8.1	18.3
DP-10-A	5.2	11.0
DP-10-B	9.7	20.3
DP-11-A	12.6	30.2
DP-11-B	8.9	21.5
DP-11-C	17.6	43.5

STORM DRAIN	Q_5 (CFS)	Q_{100} (CFS)
SD-2	26	52
SD-3	29.9	59.7
SD-8	10	18
SD-4	52.3	109.9
SD-5	58.3	122.1
SD-6	69	143



LEGEND

DESCRIPTION	SYMBOL
EXISTING GRADE INDEX CONTOUR	
EXISTING GRADE NOMINAL CONTOUR	
PROPOSED FINISH INDEX CONTOUR	6900
PROPOSED FINISH NOMINAL CONTOUR	
PROPOSED OFFSITE FINISH INDEX CONTOUR	
PROPOSED OFFSITE FINISH NOMINAL CONTOUR	
PROPOSED STORM SEWER	
EXISTING STORM SEWER	
SITE BOUNDARY	
HIGH POINT ELEVATION	HP
LOW POINT ELEVATION	LP
DIRECTION OF FLOW WITH PERCENT GRADE	1.00%
PROPOSED BASIN BOUNDARY	
PREVIOUSLY STUDIED DRAINAGE BASIN BOUNDARY	
MAJOR BASIN BOUNDARY LINE PER SAND CREEK DBPS	
PROPOSED FLOW DIRECTION	
PROPOSED OFFSITE SWALE	
PROPOSED OFFSITE FLOW DIRECTION	
NATURAL CONDITION FLOW DIRECTION	
BASIN IDENTIFIER / AREA IN ACRES	X 3.5
OTHER FILING BASIN IDENTIFIER / AREA IN ACRES	
DESIGN POINT	1
STORM DRAIN DESIGN POINT	SD-1
PROPOSED CROSSPAN	

CONTOUR INTERVAL = 2 FEET

SCALE: 1" = 50'

THE LOCATIONS OF EXISTING ABOVE GROUND AND UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL ABOVE GROUND AND UNDERGROUND UTILITIES.

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS

1-800-922-1987

CITY OF COLORADO SPRINGS DEPT. OF UTILITIES GAS, ELECTRIC, WATER AND WASTEWATER

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

AARON B. EGBERT, COLORADO P.E. #34208 DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
LENNAR COMMUNITIES COLORADO
7222 COMMERCE CENTER DRIVE
SUITE 107
COLORADO SPRINGS, CO 80919
(719) 593-8483

J·R ENGINEERING
A Westrian Company

No.	REVISION	BY	DATE
1	REVISED PER CITY REVIEW COMMENTS	ABE	12/9/05

H-SCALE 1"=50'
V-SCALE N/A
DATE 01/20/05
DESIGNED BY LJC
DRAWN BY KDC
CHECKED BY

EASTVIEW FILING NO. 3
DRAINAGE PLAN

SHEET 1 OF 1
JOB NO. 28965.08

EASTVIEW ESTATES FILING NO. 3

CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO

OVERLOT GRADING PLAN

INCLUDING EROSION CONTROL

JUNE 2005

GENERAL NOTES

1. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE EXISTENCE AND LOCATION OF ALL UNDERGROUND UTILITIES ALONG THE SITE. THE OMISSION FROM OR THE INCLUSION OF UTILITY LOCATIONS ON THE PLANS IS NOT TO BE CONSIDERED AS THE NONEXISTENCE OF OR A DEFINITE LOCATION OF EXISTING UNDERGROUND UTILITIES.
2. THE CONTRACTOR WILL TAKE THE NECESSARY PRECAUTIONS TO PROTECT EXISTING UTILITIES, BUILDINGS, FENCES, AND ROADWAYS FROM DAMAGE DUE TO THIS OPERATION. ANY DAMAGE TO THE ABOVE WILL BE REPAIRED AT THE CONTRACTOR'S EXPENSE, AND ANY SERVICE DISRUPTION WILL BE SETTLED BY THE CONTRACTOR.
3. OVERLOT GRADING SHALL BE COMPLETED TO A SUBGRADE TOLERANCE OF PLUS OR MINUS 0.2'.
4. CONTRACTOR SHALL OBTAIN COPIES OF THE SOILS REPORT FROM THE GEOTECHNICAL ENGINEER, AND THEY SHALL BE KEPT ONSITE DURING ALL EARTHWORK OPERATIONS.
5. THE SITE SHALL BE STRIPPED A MINIMUM OF 0.5' BELOW EXISTING GRADE.
6. MAXIMUM CUT/FILL SLOPES SHALL NOT EXCEED 3:1, UNLESS OTHERWISE NOTED.
7. DUST CONTROL SHALL BE SUPPLIED BY THE GRADING CONTRACTOR THROUGH THE DURATION OF OVERLOT GRADING ACTIVITIES PER THE COUNTY HEALTH DEPARTMENT SPECIFICATIONS.
8. **BENCHMARKS:**

   A. 3-1/2" ALUMINUM CAP IN VALVE BOX AT THE NORTHEAST CORNER SECTION 20, T13S R65W. INTERSECTION MARKSHEFFEL ROAD AND STETSON HILLS BOULEVARD.
   EL = 6774.39

   B. 1/4 CORNER SECTIONS 20/21, 3-1/2" ALUMINUM CAP IN VALVE BOX, MARKSHEFFEL ROAD.
   EL = 6700.59

GRADING/EROSION CONTROL PLAN NOTES:

1. ANY LAND DISTURBANCE BY ANY OWNER, DEVELOPER, BUILDER, CONTRACTOR, OR OTHER PERSON SHALL COMPLY WITH THE BASIC GRADING, EROSION ADN STORMWATER QUALITY CONTROL REQUIREMENTS AND GENERAL PROHIBITIONS NOTED IN THE DRAINAGE CRITERIA MANUAL, VOLUME 2.
2. NO CLEARING, GRADING, EXCAVATION, FILLLING OR OTHER LAND DISTURBING ACTIVITES SHALL BE PERMITEED UNTIL SIGNOFF AND ACCEPTANCE OF THE GRADING PLAN AND EROSION AND STORMWATER QUALITY CONTROL PLAN IS RECEIVED FROM CITY ENGINEERING.
3. THE INSTALLATION OF THE FIRST LEVEL OF TEMPORARY EROSION CONTROL FACILITIES AND BMP'S SHALL BE INSTALLED AND INSPECTED PRIOR TO ANY EARTH DISTURBANCE OPERATIONS TAKING PLACE. CALL CITY STORMWATER INSPECTIONS, 385-5980, 48 HOURS PRIOR TO CONSTRUCTION.
4. SEDIMENT (MUD AND DIRT) TRANSPORTED ONTO A PUBLIC ROAD, REGARDLESS OF THE SIZE OF THE SITE, SHALL BE CLEANED AT THE END OF EACH DAY.
5. CONCRETE WASH WATER SHAL NOT BE DISCHARGED TO OR ALLOWED TO RUNOFF TO STATE WATERS, INCLUDING ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR FACILITIES.
6. SOIL EROSION CONTROL MEASURES FOR ALL SLOPES,CHANNELS, DITCHES, OR ANY DISTURBED LAND AREA SHALL BE COMPLETED WITHIN TWENTY-ONE (21) CALENDAR DAYS AFTER FINAL GRADING OR FINAL EARTH DISTURBANCE HAS BEEN COMPLETED. DISTURBED AREAS AND STOCKPILES WHICH ARE NOT AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN 30 DAYS SHALL ALSO BE MULCHED WITHIN 21 DAYS AFTER INTERIM GRADING. AN AREA THAT IS GOING TO REMAIN IN AN INTERIM STATE FOR MORE THAN 60 DAYS SHALL ALSO BE SEEDED. ALL TEMPORARY SOIL EROSION CONTROL MEASURES AND BMP'S SHALL BE MAINTAINED UNTIL PERMANENT SOIL EROSION CONTROL MEASURES ARE IMPLEMENTED.
7. THE GRADING AND EROSION CONTROL PLAN WILL BE SUBJECT TO RE-REVIEW AND RE-ACCEPTANCE BY THE CITY OF COLORADO SPRING ENGINEERING SHOULD ANY OF THE FOLLOWING OCCUR: GRADING DOES NOT COMMENCE WITH 12 MONTHS OF THE CITY ENGINEER'S ACCEPTANCE OF THE PLAN; A CHANGE IN PROPERTY OWNERSHIP; PROPOSED DEVELOPMENT CHANGES; OR PROPOSED GRADING REVISIONS.
8. THE PLAN SHALL NOT SUBSTANTIALLY CHANGE THE DEPTH OF COVER, OR ACCESS TO UTILITY FACILITIES. ADDITIONALLY, THE PLAN SHALL NOT INCREASE OR DIVERT WATER TOWARDS UTILITY FACILITIES. ANY CHANGES TO UTILITY FACILITIES TO ACCOMMODATE THE PLAN MUST BE DISCUSSED AND AGREED TO BY THE AFFECTED UTILITY PRIOR TO IMPLEMENTING THE PLAN. THE RESULTING COST TO RELOCATE OR PROTECT UTILITIES, OR PROVIDE INTERIM ACCESS IS AT THE EXPENSE OF THE PLAN APPLICANT.

TIMING: ANTICIPATED STARTING AND COMPLETION TIME PERIOD OF ALL GRADING: JAN. 2006 TO JULY 2006

EXPECTED DATE ON WHICH THE FINAL STABLIZATION WILL BE COMPLETED: AUG. 2006

AREAS: TOTAL AREA OF THE SITE TO BE CLEARED, EXCAVATED OR GRADED: 7.270 ACRES

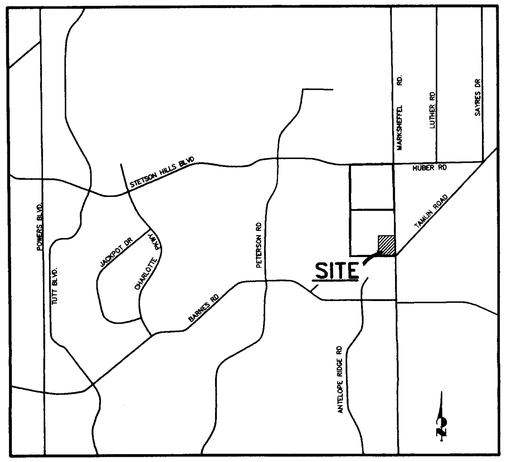
RECEIVING WATERS:
NAME OF RECEIVING WATERS: SAND CREEK

EROSION CONTROL COST ESTIMATE:

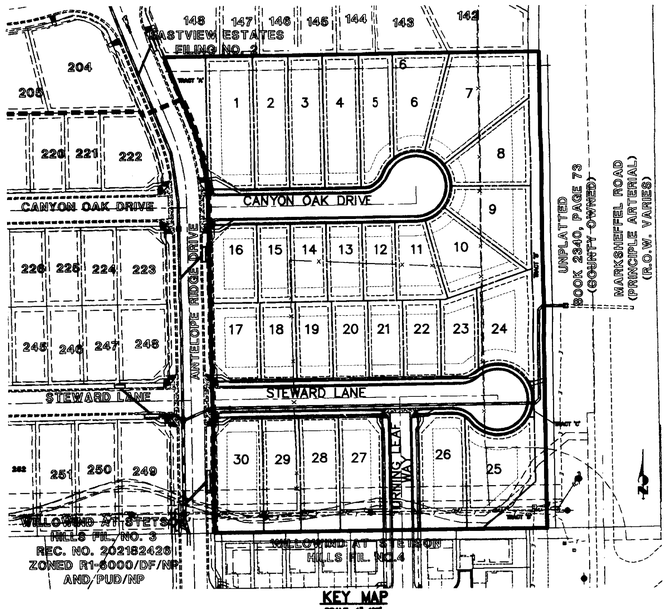
1. 770 LF SILT FENCE @ $1.50/LF		$ 1,155.00
2. 5 EACH – STRAW BALE CHECK DAM @ $12.00/DAM INCL. LABOR		$ 60.00
3. 2 EACH – VEHICLE TRACKING CONTROL @ $500.00/EACH		$ 1,000.00
4. 1 EACH – INLET PROTECTION @ $40.00/EACH		$ 40.00
	SUB TOTAL	$ 2,255.00
5. 25% MAINTENANCE AND REPLACEMENT		$ 564.00
	TOTAL	$ 2,819.00

JR ENGINEERING, LLC CANNOT AND DOES NOT GUARANTEE THAT THE CONSTRUCTION COSTS WILL NOT VARY FROM THESE OPINIONS OR PROBABLE CONSTRUCTION COSTS. THESE OPINIONS REPRESENT OUR BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY AND IN THIS DEVELOPMENT.

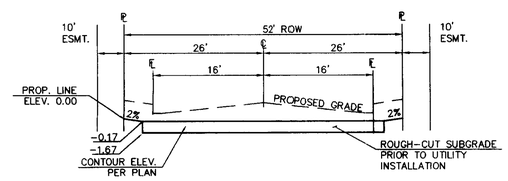
SHEET INDEX



VICINITY MAP
N.T.S.



KEY MAP
SCALE: 1"=100'



TYPICAL ROUGH CUT SECTION 52' R.O.W.
NOT TO SCALE

AGENCIES:

DEVELOPER:	LENNAR COMMUNITIES COLORADO 9990 PARK MEADOWS DRIVE LONETREE, CO 80124 MS. KIM COOPER, (303) 754-0600
CIVIL ENGINEER:	JR ENGINEERING 4310 ARROWSWEST DRIVE COLORADO SPRINGS, COLORADO 80907-3449 MR. AARON B. EGBERT, P.E. (719) 593-2593
ENGINEERING DIVISION:	CITY OF COLORADO SPRINGS 30 S. NEVADA AVENUE, SUITE 702 COLORADO SPRINGS, COLORADO 80903 MR. TIM MITROS, (719) 385-5061
TRAFFIC ENGINEERING	CITY OF COLORADO SPRINGS 30 S. NEVADA AVENUE COLORADO SPRINGS, COLORADO 80903 MR. DAVE KRAUTH, (719) 385-5908
DEVELOPMENT SERVICES:	WASTEWATER DIVISION: CITY OF COLORADO SPRINGS 111 S. CASCADE COLORADO SPRINGS, COLORADO 80905 MR. MATTHEW WILLIAMS, (719) 668-7211 WATER DIVISION: MR. AL JUVERA, (719) 668-8264
GAS DEPARTMENT:	CITY OF COLORADO SPRINGS 101 S. CONEJOS STREET COLORADO SPRINGS, COLORADO 80903 MR. CHARLES CHACON, (719) 668-3565
ELECTRIC DEPARTMENT:	CITY OF COLORADO SPRINGS 30 S. NEVADA AVENUE COLORADO SPRINGS, COLORADO 80903 MR. TONY SIDES, (719) 668-4967
TELEPHONE COMPANY:	U.S. WEST COMMUNICATIONS (LOCATORS) (800) 922-1987 A.T.& T. (LOCATORS) (719) 635-3674

APPROVALS:

THIS EROSION CONTROL/GRADING PLAN WAS PREPARED UNDER MY DIRECTION AND SUPERVISION AND IS COREECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. IF SUCH WORK IS PERFORMED IN ACCORDANCE WITH THIS GRADING AND EROSION CONTROL PLAN, THE WORK WILL NOT BECOME A HAZARD TO LIFE AND LIMB, ENDANGER PROPERTY, OR ADVERSELY AFFECT THE SAFETY, USE, OR STABILITY OF A PUBLIC WAY, DRAINAGE CHANNEL, OR OTHER PROPERTY.

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

COLORADO REGISTERED PROFESSIONAL ENGINEER 34208

AARON B. EGBERT, ON BEHALF OF JR ENGINEERING, P.E. # 34208 — DATE 2-8-06

OWNER/DEVELOPER STATEMENT:

THE OWNER WILL COMPLY WITH THE REQUIREMENTS OF THE EROSION AND STORMWATER QUALITY CONTROL PLAN. I ACKNOWLEDGE THE RESPONSIBILITY TO DETERMINE WHETHER THE CONSTRUCTION ACTIVITIES ON THESE PLANS REQUIRE COLORADO DISCHARGE PERMIT SYSTEM (CDPS) PERMITTING FOR STORMWATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY.

OWNER/DEVELOPER — DATE 2/8/06

DBA: LENNAR COMMUNITIES COLORADO
BUSINESS NAME

TITLE:

ADDRESS: 9990 PARK MEADOWS DRIVE

LONETREE, CO 80124

CITY OF COLORADO SPRINGS
GRADING AND EROSION CONTROL REVIEW

THIS GRADING PLAN IS FILED IN ACCORDANCE WITH SECTION 7.7.1503 (ENACTED AS ORD. 82-56) OF THE CODE OF THE CITY OF COLORADO SPRINGS, 2001, AS AMENDED. EROSION CONTROL IS REVIEWED IN ACCORDANCE WITH THE DRAINAGE CRITERIA MANUAL, VOL. 1 (OCTOBER 1994) AND VOL. 2 (AUGUST 2002); LATEST REVISIONS.

FOR THE CITY ENGINEER
CITY OF COLORADO SPRINGS — DATE Feb 11, 2006

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEM FOR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
LENNAR COMMUNITIES COLORADO
9990 PARK MEADOWS DRIVE
LONETREE, CO 80124
303.754.0600

J.R. ENGINEERING
A Westrian Company
4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax 719-528-6848
www.jrengineering.com

No.	REVISION	BY	DATE
1.	PER CITY REVIEW COMMENTS	kad	11/10/05

H-SCALE	N/A	DESIGNED BY	JLH
V-SCALE	N/A	DRAWN BY	AJF
DATE	6/3/05	CHECKED BY	

EASTVIEW ESTATES FILING NO. 3

OVERLOT GRADING PLAN
INCLUDING EROSION CONTROL

TITLE SHEET

SHEET 1 OF 4

JOB NO. 28965.08

FILE: 3

X:\28965000.all\28965608\Drawings\Sheet Dwgs\28965608SO01.dwg, 24x36 Construction Title, 2/8/2006 9:51:18 AM, dodgek

EASTVIEW ESTATES FILING NO. 3

CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO

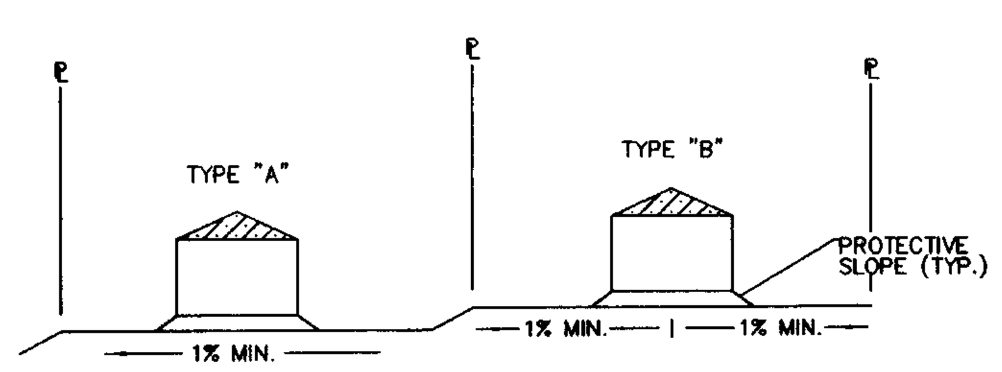
OVERLOT GRADING PLAN

INCLUDING EROSION CONTROL

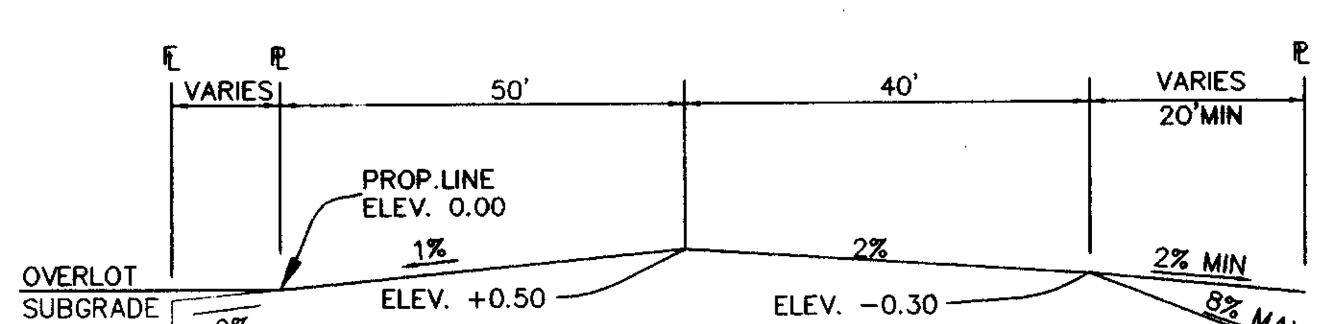
JUNE 2005

LEGEND

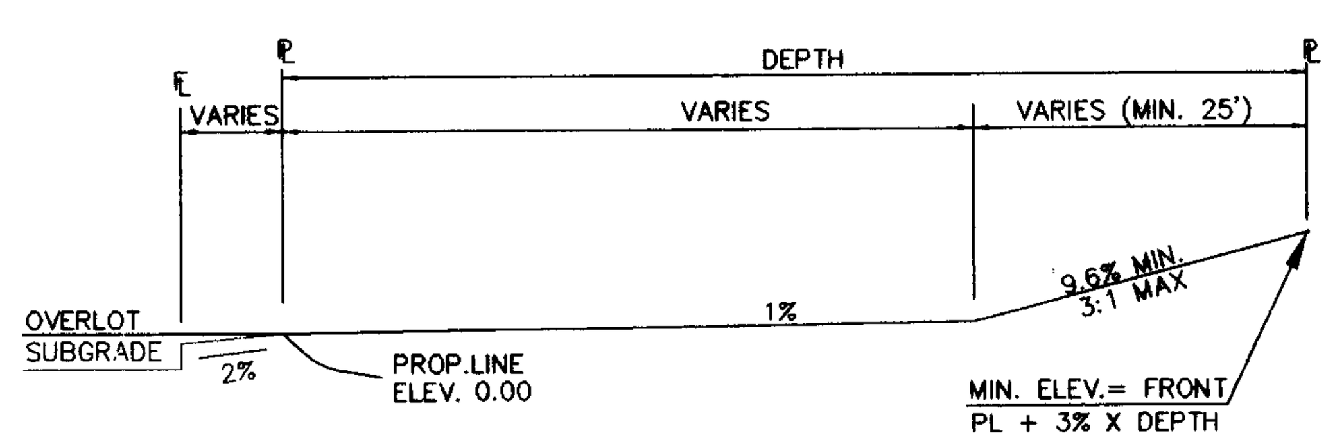
DESCRIPTION	SYMBOL
10' EXIST. GROUND CONTOUR	6000
2' EXIST. GROUND CONTOUR	
10' PROP. GROUND CONTOUR	6000
2' PROP. GROUND CONTOUR	
PROPOSED STORM SEWER	
EXISTING STORM SEWER	
EXISTING WATER MAIN	
EXISTING SANITARY SEWER MAIN	
EXISTING ELECTRIC	
EXISTING GAS MAIN	G
EXISTING OVERHEAD UTILITY	OHU
EXISTING TELEPHONE	T
DIRECTION OF FLOW W/ PERCENT GRADE	4.00%
LOW POINT	LP
HIGH POINT	HP



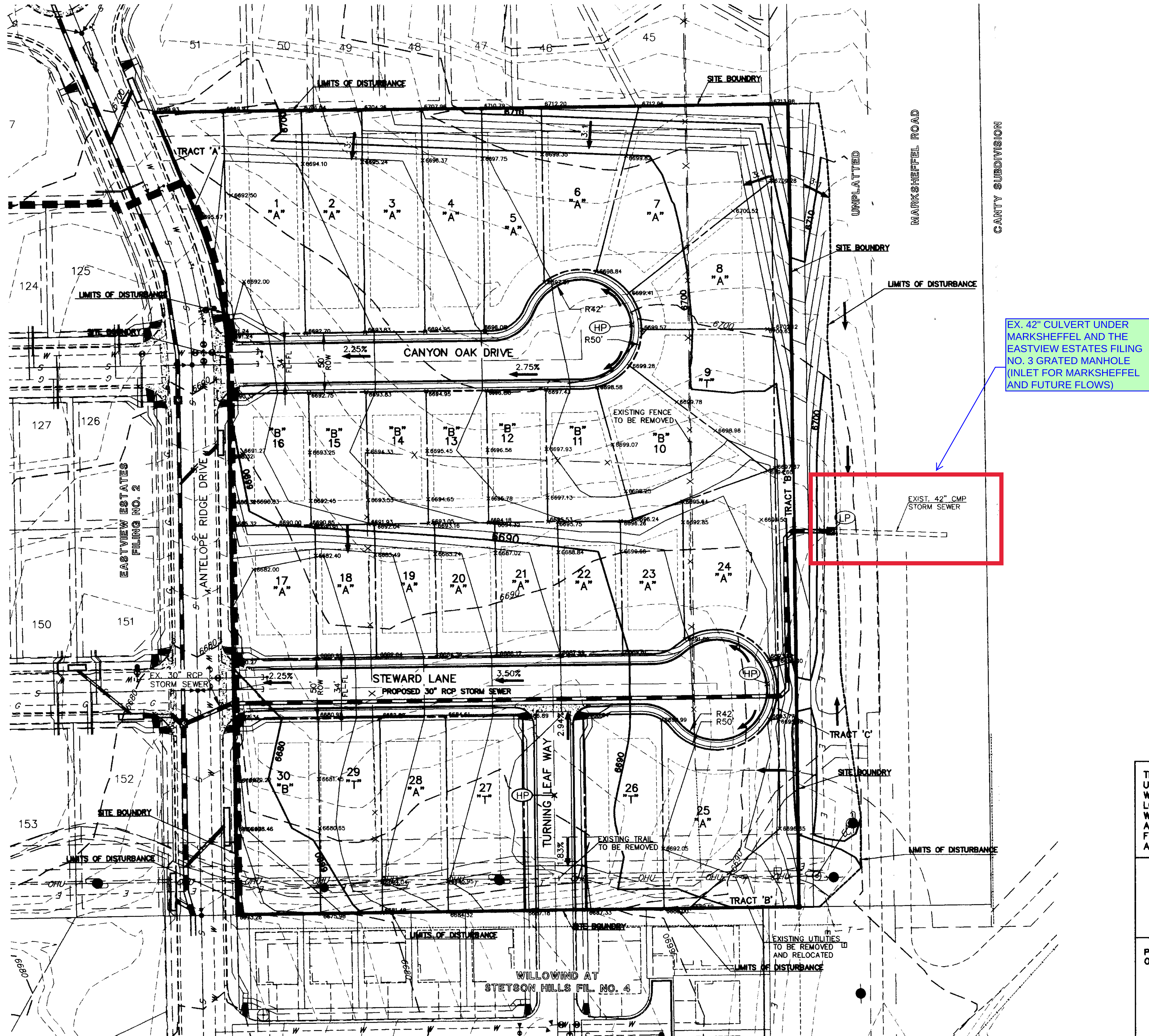
TYPICAL LOT SECTION DETAIL
NOT TO SCALE



TYPICAL "B" LOT
NOT TO SCALE



TYPICAL "A" LOT
NOT TO SCALE



THE LOCATIONS OF EXISTING ABOVE GROUND AND UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL ABOVE GROUND AND UNDERGROUND UTILITIES.

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
1-800-922-1987
UTILITY NOTIFICATION CENTER OF COLORADO
GAS, ELECTRIC, WATER AND WASTEWATER

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

AARON B. EGBERT, COLORADO P.E. #34208 — 2-8-06
DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
LENNAR COMMUNITIES COLORADO
9990 PARK MEADOWS DRIVE
LONETREE, CO 80124
303.754.0600

J·R ENGINEERING
A Westrian Company
4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax 719-528-6613
www.jrengineering.com

No.	REVISION	BY	DATE
1.	PER CITY REVIEW COMMENTS	kad	11/10/05

H-SCALE	1"=20'
V-SCALE	N/A
DATE	6/6/05
DESIGNED BY	JLH
DRAWN BY	AJF
CHECKED BY	

EASTVIEW ESTATES FILING NO. 3
OVERLOT GRADING PLAN
INCLUDING EROSION CONTROL
GRADING PLAN

SHEET 2 OF 4
JOB NO. 28965.08

PARK ENGINEERING CONSULTANTS

NEW DOC

Technical Memorandum

To: Brad R Bonnet, Allred & Associates.

From: Joel Seamons, PE, Park Engineering Consultants

Date: 12/14/2015; Revised 01/18/2015, Revised 2/17/16, Revised 3/21/16, Revised 7/5/16

Re: Drainage Technical Memo – Trojan Storage 246-67

Design Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

COLORADO REGISTERED JOEL A. SEAMONS 37162 7-5-16 PROFESSIONAL ENGINEER

Name, P.E. #

7-5-16

Date

Owner/Developer's Statement:

I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.

Name, Title: Brett Henry

7/11/16

Date

Business Name: Trojan Storage of Stetson Hills, LLC

Address: 1732 Aviation Blvd #217
Redondo Beach, CA 90278

El Paso County:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

28 July 2014

~~Andre P. Brackin~~, P.E., JENNIFER E. IRVINE
County Engineer / ECM Administrator

Date

Conditions:

The purpose of this memo is to verify the drainage concept and redesign of the detention pond due to site differing existing conditions for the development of Trojan Storage in Colorado Springs.

Trojan Storage is located at 5210 Tamlin Road Colorado Springs, CO 80938. Currently, this storage complex has 4 existing buildings with a total area of 51,114 sqft. It also has some gravel roads, parking and asphalt pavement at several locations. It also has an existing detention pond with a current capacity of 22,409 cuft plus 1' of freeboard.

The whole site consists of 16.9 acres and it is divided into 3 major basins (two offsite basins and one onsite basin). The West offsite basin (OSW) has 9.98 acres and consists mainly of gravel parking and drains offsite to the southwest. This basin has an imperviousness of 5%. The East offsite basin (OSE) has 1.37 acres it consists mainly of the landscape and swale areas along the edges of the east side of the property. It also includes the southern boundaries of the detention pond. This basin has an imperviousness of 7%.

The only basin that flows into the existing detention pond is basin E. It consists of 5.55 acres, and will have a final imperviousness of 86% after the proposed storage buildings and asphalt driveways get built. It drains into the existing detention pond located on the south of this basin.

The original drainage report titled "Final Drainage Report for a portion of Lot 3, Canty Subdivision No. 2 (Highfields Storage)," was prepared by Classic Consulting Engineers and dated May 2002. According to this report, the original detention pond was designed to hold 1.29 acre-feet (56,192 cuft) but for reasons out of our knowledge it was built smaller than than (estimated existing capacity 22,409 cuft). The existing outlet structure was designed to release 0.6 cfs on the minor 5 year storm and 8 cfs on the 100 year storm.

The expansion project consists of adding 5 additional storage buildings to the existing complex. Out of those 5 buildings only 3 are being planned to be constructed right now and the 3 buildings to the northeast are being considered for the future.

After performing the detention pond calculations by Full Spectrum method (100 yr + 1/2WQCV), it is determined that the new required capacity for the detention pond needs to be 0.92 acre-feet (40,075 cuft). The allowable release rate is 5.55 cfs and the outlet will be designed to drain in 72 hours EURV.

The existing detention pond will be expanded to the north and west in order to expand its capacity. A retaining wall is also being added around the perimeter of the expanded pond in order to obtain the required volume for water quality and detention requirements. The expanded detention pond, as it is being proposed, will have a stage storage capacity of 41,655 cuft plus 1' of freeboard which is more than the required capacity.

The existing pond is also being retrofitted by adding a 0.5% slope concrete trickle pan and a micropool. The micropool will be lined with 6" thick concrete, it will have a surface area of 64 sqft and 2.5' of depth, with an initial surcharge of 4".

The outlet structure is also being retrofitted. The new orifice plate will have 2 rows of 1.41" Ø orifices spaced 11" to drain the EURV in a period of 72 hours. It will also have an 9.0" orifice with an invert at 85.50 and a top weir 2.0' wide with an invert of 86.40 for 100 yr flow.

The existing 30" outlet RCP and flared end section have enough capacity to carry the 100 yr allowable flow (5.55 cfs). This existing pipe has a slope of 3.2% and on the 100 yr event it will only fill up to 0.44' as shown on the attached circular pipe flow calculation.

The existing emergency spillway will be retrofitted to be able to handle the 100 yr flow. The location of the emergency spillway is shown on the drainage plan and the new dimensions are 13' (Bottom width) by 6" high. This emergency spillway has a capacity for the 100 yr flow (24.86 cfs) with a high water elevation of .49' above the low part of the weir, which will still keep it below the top of pond elevation. The downstream face of the emergency spillway will be lined with type "M" riprap on a blanket 13' wide by 20' long.

At the bottom of the outlet pipe flared end section a riprap dissipater is being proposed. It is proposed to be 13' wide and 15' long. The detail for this flow dissipater can be found on the drainage drawings.

An 8' wide stabilized access is also being installed in the detention. This access will have a maximum slope of 15% as indicated on plans.

Please let me know if you have any questions.

GRADING & EROSION CONTROL PLANS
TROJAN STORAGE

LOT 3, CANTY SUBDIVISION NO. 2
Located in a portion of Sec. 21, T13S, R65W of the 6TH P.M.
County of El Paso, State of Colorado

STANDARD NOTES FOR EL PASO COUNTY GRADING AND EROSION CONTROL PLANS

REVISED 7/07/10

1. CONSTRUCTION MAY NOT COMMENCE UNTIL A CONSTRUCTION PERMIT IS OBTAINED FROM DEVELOPMENT SERVICES AND A PRECONSTRUCTION CONFERENCE IS HELD WITH DEVELOPMENT SERVICES INSPECTIONS.

2. STORMWATER DISCHARGES FROM CONSTRUCTION SITES SHALL NOT CAUSE OR THREATEN TO CAUSE POLLUTION, CONTAMINATION, OR DEGRADATION OF STATE WATERS. ALL WORK AND EARTH DISTURBANCE SHALL BE DONE IN A MANNER THAT MINIMIZES POLLUTION OF ANY ON-SITE OR OFF SITE WATERS, INCLUDING WETLANDS.

3. NOTWITHSTANDING ANYTHING DEPICTED IN THESE PLANS IN WORDS OR GRAPHIC REPRESENTATION, ALL DESIGN AND CONSTRUCTION RELATED TO ROADS, STORM DRAINAGE AND EROSION CONTROL SHALL CONFORM TO THE STANDARDS AND REQUIREMENTS OF THE MOST RECENT VERSION OF THE RELEVANT ADOPTED EL PASO COUNTY STANDARDS, INCLUDING THE LAND DEVELOPMENT CODE, THE ENGINEERING CRITERIA MANUAL, THE DRAINAGE CRITERIA MANUAL, AND THE DRAINAGE CRITERIA MANUAL VOLUME 2. ANY DEVIATIONS TO REGULATIONS AND STANDARDS MUST BE REQUESTED, AND APPROVED, IN WRITING.

4. A SEPARATE STORMWATER MANAGEMENT PLAN (SWMP) FOR THIS PROJECT SHALL BE COMPLETED AND AN EROSION AND STORMWATER QUALITY CONTROL PERMIT (ESQCP) ISSUED PRIOR TO COMMENCING CONSTRUCTION. DURING CONSTRUCTION THE SWMP IS THE RESPONSIBILITY OF THE DESIGNATED STORMWATER MANAGER, SHALL BE LOCATED ON SITE AT ALL TIMES AND SHALL BE KEPT UP TO DATE WITH WORK PROGRESS AND CHANGES IN THE FIELD.

5. ONCE THE ESQCP HAS BEEN ISSUED, THE CONTRACTOR MAY INSTALL THE INITIAL STAGE EROSION AND SEDIMENT CONTROL BMPS AS INDICATED ON THE GEC. A PRECONSTRUCTION MEETING BETWEEN THE CONTRACTOR, ENGINEER, AND EL PASO COUNTY WILL BE HELD PRIOR TO ANY CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE APPLICANT TO COORDINATE THE MEETING TIME AND PLACE WITH COUNTY DSD INSPECTIONS STAFF.

6. SOIL EROSION CONTROL MEASURES FOR ALL SLOPES, CHANNELS, DITCHES, OR ANY DISTURBED LAND AREA SHALL BE COMPLETED WITHIN 21 CALENDAR DAYS AFTER FINAL GRADING, OR FINAL EARTH DISTURBANCE, HAS BEEN COMPLETED. DISTURBED AREAS AND STOCKPILES WHICH ARE NOT AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN 30 DAYS SHALL ALSO BE MULCHED WITHIN 21 DAYS AFTER INTERIM GRADING. AN AREA THAT IS GOING TO REMAIN IN AN INTERIM STATE FOR MORE THAN 60 DAYS SHALL ALSO BE SEEDED. ALL TEMPORARY SOIL EROSION CONTROL MEASURES AND BMPS SHALL BE MAINTAINED UNTIL PERMANENT SOIL EROSION CONTROL MEASURES ARE IMPLEMENTED AND ESTABLISHED.

7. TEMPORARY SOIL EROSION CONTROL FACILITIES SHALL BE REMOVED AND EARTH DISTURBANCE AREAS GRADED AND STABILIZED WITH PERMANENT SOIL EROSION CONTROL MEASURES PURSUANT TO STANDARDS AND SPECIFICATION PRESCRIBED IN THE DCM VOLUME II AND THE ENGINEERING CRITERIA MANUAL (ECM) APPENDIX I.

8. ALL PERSONS ENGAGED IN EARTH DISTURBANCE SHALL IMPLEMENT AND MAINTAIN ACCEPTABLE SOIL EROSION AND SEDIMENT CONTROL MEASURES INCLUDING BMPS IN CONFORMANCE WITH THE EROSION CONTROL TECHNICAL STANDARDS OF THE DRAINAGE CRITERIA MANUAL (DCM) VOLUME II AND IN ACCORDANCE WITH THE STORMWATER MANAGEMENT PLAN (SWMP).

9. ALL TEMPORARY EROSION CONTROL FACILITIES INCLUDING BMPS AND ALL PERMANENT FACILITIES INTENDED TO CONTROL EROSION OF ANY EARTH DISTURBANCE OPERATIONS, SHALL BE INSTALLED AS DEFINED IN THE APPROVED PLANS, THESWMP AND THE DCM VOLUME II AND MAINTAINED THROUGHOUT THE DURATION OF THE EARTH DISTURBANCE OPERATION.

10. ANY EARTH DISTURBANCE SHALL BE CONDUCTED IN SUCH A MANNER SO AS TO EFFECTIVELY REDUCE ACCELERATED SOIL EROSION AND RESULTING SEDIMENTATION. ALL DISTURBANCES SHALL BE DESIGNED, CONSTRUCTED, AND COMPLETED SO THAT THE EXPOSED AREA OF ANY DISTURBED LAND SHALL BE LIMITED TO THE SHORTEST PRACTICAL PERIOD OF TIME.

11. ANY TEMPORARY OR PERMANENT FACILITY DESIGNED AND CONSTRUCTED FOR THE CONVEYANCE OF STORMWATER AROUND, THROUGH, OR FROM THE EARTH DISTURBANCE AREA SHALL BE DESIGNED TO LIMIT THE DISCHARGE TO A NON-EROSIVE VELOCITY.

12. CONCRETE WASH WATER SHALL BE CONTAINED AND DISPOSED OF IN ACCORDANCE WITH THE SWMP. NO WASH WATER SHALL BE DISCHARGED TO OR ALLOWED TO RUNOFF TO STATE WATERS, INCLUDING ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR FACILITIES.

13. EROSION CONTROL BLANKETING IS TO BE USED ON SLOPES STEEPER THAN 3:1.

14. BUILDING, CONSTRUCTION, EXCAVATION, OR OTHER WASTE MATERIALS SHALL NOT BE TEMPORARILY PLACED OR STORED IN THE STREET, ALLEY, OR OTHER PUBLIC WAY, UNLESS IN ACCORDANCE WITH AN APPROVED TRAFFIC CONTROL PLAN. BMP'S MAY BE REQUIRED BY EL PASO COUNTY ENGINEERING IF DEEMED NECESSARY, BASED ON SPECIFIC CONDITIONS AND CIRCUMSTANCES.

15. VEHICLE TRACKING OF SOILS AND CONSTRUCTION DEBRIS OFF-SITE SHALL BE MINIMIZED. MATERIALS TRACKED OFFSITE SHALL BE CLEANED UP AND PROPERLY DISPOSED OF IMMEDIATELY.

16. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL WASTES FROM THE CONSTRUCTION SITE FOR DISPOSAL IN ACCORDANCE WITH LOCAL AND STATE REGULATORY REQUIREMENTS. NO CONSTRUCTION DEBRIS, TREE SLASH, BUILDING MATERIAL WASTES OR UNUSED BUILDING MATERIALS SHALL BE BURIED, DUMPED, OR DISCHARGED AT THE SITE.

17. THE OWNER, SITE DEVELOPER, CONTRACTOR, AND/OR THEIR AUTHORIZED AGENTS SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL CONSTRUCTION DEBRIS, DIRT, TRASH, ROCK, SEDIMENT, AND SAND THAT MAY ACCUMULATE IN THE STORM SEWER OR OTHER DRAINAGE CONVEYANCE SYSTEM AND STORMWATER APPURTENANCES AS A RESULT OF SITE DEVELOPMENT.

18. THE QUANTITY OF MATERIALS STORED ON THE PROJECT SITE SHALL BE LIMITED, AS MUCH AS PRACTICAL, TO THAT QUANTITY REQUIRED TO PERFORM THE WORK IN AN ORDERLY SEQUENCE. ALL MATERIALS STORED ON-SITE SHALL BE STORED IN A NEAT, ORDERLY MANNER, IN THEIR ORIGINAL CONTAINERS, WITH ORIGINAL MANUFACTURER'S LABELS.

19. NO CHEMICALS ARE TO BE USED BY THE CONTRACTOR, WHICH HAVE THE POTENTIAL TO BE RELEASED IN STORMWATER UNLESS PERMISSION FOR THE USE OF A SPECIFIC CHEMICAL IS GRANTED IN WRITING BY THE ECM ADMINISTRATOR. IN GRANTING THE USE OF SUCH CHEMICALS, SPECIAL CONDITIONS AND MONITORING MAY BE REQUIRED.

20. BULK STORAGE STRUCTURES FOR PETROLEUM PRODUCTS AND OTHER CHEMICALS SHALL HAVE ADEQUATE PROTECTION SO AS TO CONTAIN ALL SPILLS AND PREVENT ANY SPILLED MATERIAL FROM ENTERING STATE WATERS, INCLUDING ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR FACILITIES.

21. NO PERSON SHALL CAUSE THE IMPEDIMENT OF STORMWATER FLOW IN THE FLOW LINE OF THE CURB AND GUTTER OR IN THE DITCHLINE.

22. INDIVIDUALS SHALL COMPLY WITH THE "COLORADO WATER QUALITY CONTROL ACT" (TITLE 25, ARTICLE 8, CRS), AND THE "CLEAN WATER ACT" (33 USC 1344). IN ADDITION TO THE REQUIREMENTS INCLUDED IN THE DCM VOLUME II AND THE ECM APPENDIX I, ALL APPROPRIATE PERMITS MUST BE OBTAINED BY THE CONTRACTOR PRIOR TO CONSTRUCTION (NPDES, FLOODPLAIN, 404, FUGITIVE DUST, ETC.). IN THE EVENT OF CONFLICTS BETWEEN THESE REQUIREMENTS AND LAWS, RULES, OR REGULATIONS OF OTHER FEDERAL, STATE, OR COUNTY AGENCIES, THE MORE RESTRICTIVE LAWS, RULES, OR REGULATIONS SHALL APPLY.

23. ALL CONSTRUCTION TRAFFIC MUST ENTER/EXIT THE SITE AT APPROVED CONSTRUCTION ACCESS POINTS.

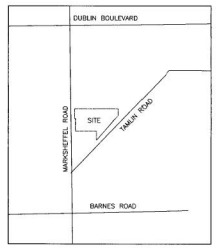
24. PRIOR TO ACTUAL CONSTRUCTION THE PERMITEE SHALL VERIFY THE LOCATION OF EXISTING UTILITIES.

25. A WATER SOURCE SHALL BE AVAILABLE ON SITE DURING EARTHWORK OPERATIONS AND UTILIZED AS REQUIRED TO MINIMIZE DUST FROM EARTHWORK EQUIPMENT AND WIND.

26. THE SOILS REPORT FOR THIS SITE HAS BEEN PREPARED BY HEPWORTH-PAWLAK GEOTECHNICAL INC, 215267A, 08/28/15 AND SHALL BE CONSIDERED A PART OF THESE PLANS.

27. AT LEAST TEN DAYS PRIOR TO THE ANTICIPATED START OF CONSTRUCTION, FOR PROJECTS THAT WILL DISTURB 1 ACRE OR MORE, THE OWNER OR OPERATOR OF CONSTRUCTION ACTIVITY SHALL SUBMIT A PERMIT APPLICATION FOR STORMWATER DISCHARGE TO THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, WATER QUALITY DIVISION. THE APPLICATION CONTAINS CERTIFICATION OF COMPLETION OF A STORMWATER MANAGEMENT PLAN (SWMP), OF WHICH THIS GRADING AND EROSION CONTROL PLAN MAY BE A PART. FOR INFORMATION OR APPLICATION MATERIALS CONTACT:

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
WATER QUALITY CONTROL DIVISION
WQCD - PERMITS
4300 CHERRY CREEK DRIVE SOUTH
DENVER, CO 80246-1530
ATTN: PERMITS UNIT



VICINITY MAP
N.T.S.

SHEET INDEX:

EL PASO COUNTY STANDARD SIGNATUE BLOCK

GRADING AND EROSION CONTROL PLANS (STANDLONE)

DESIGN ENGINEER'S STATEMENT:

THIS GRADING AND EROSION CONTROL PLAN WAS PREPAED UNDER MY DIRECTION AND SUPERVISION AND IS CORRECT TO THE EST OF MY KNOWLEDGE AND BELIEF. SAID PLAN HAS BEEN PREPARD ACCORDING TO THE CRITERIA ESTABLISHED BY THE COUNTY FOR GRDING AND EROSION CONTROL PLANS. I ACCEPT RESPONSIBILITY FOI ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSION ON MY PART IN PREPARING THIS PLAN.

NAME, P.E. DATE

OWNER/DEVELOPER'S STATEMENT:

I, THE OWNER/DEVELOPER HAVE READ AND WILL COMPLY WITH THE REQUIREMENTS OF THE GRADING AND EROSION CONTROLPLAN.

BRETT HENRY 01/18/16

TROJAN STORAGE
1732 AVIATION BLVD, SUITE 217
REDONDO BEACH, CA 90278

EL PASO COUNTY:

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURAC OF THIS DOCUMENT.

FILED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EL PASO COUNTY LAND DEVELOPMENT CODE, DRAINAGE CRITERIA MANUAL, VOLUMES 1 AND 2, AND ENGINEERING CRITERIA MANUAL AS AMENDED.

ANDRE P. BRACKIN, P.E., DATE
COUNTY ENGINEER / ECM ADMINISTRATOR

PROJECT CONTACTS

OWNER:
TROJAN STORAGE
BRETT HENRY
310-372-8600
BHENRY@TROJANSTORAGE.COM
1732 AVIATION BLVD, SUITE 217
REDONDO BEACH, CA 90278

ARCHITECT:
ALLRED & ASSOCIATES
BRAD BONNET
TEL: 303-465-4306
580 BURBANK ST, SUITE 125
BROOMFIELD, CO 80020
BRAD@ALLREDARCH.COM

CIVIL ENGINEER:
PARK ENGINEERING CONSULTANTS
JOEL R. SEAMONS, P.E.
420 21ST AVENUE, SUITE 101
LONGMONT, CO 80501
303.651.6626 2# (O)
303.651.0331 (F)
JOEL@PARKENGINEERING.NET

SURVEYOR:
PINNACLE LAND SURVEYING, INC
JOHN W. TOWNER
121 COUNTY ROAD 5,
DIVIDE, CO 80814

CONTRACTOR
ABERDEEN CONSTRUCTION
TEL: 303-635-2633
FAX: 303635-2297
4158 JASON ST
DENVER, CO 80211

COUNTY:
EL PASO COUNTY
DEVELOPMENT SERVICES
2880 INTERNATIONAL CIRCLE, SUITE 110
COLORADO SPRINGS, CO 80910
TELEPHONE: (719)520-6300
FAX: (719)520-6695

UTILITIES:
COLORADO SPRINGS UTILITIES
111 S. CASCADE AVE.
COLORADO SPRINGS, CO 80903
719-448-4800
800-238-5434

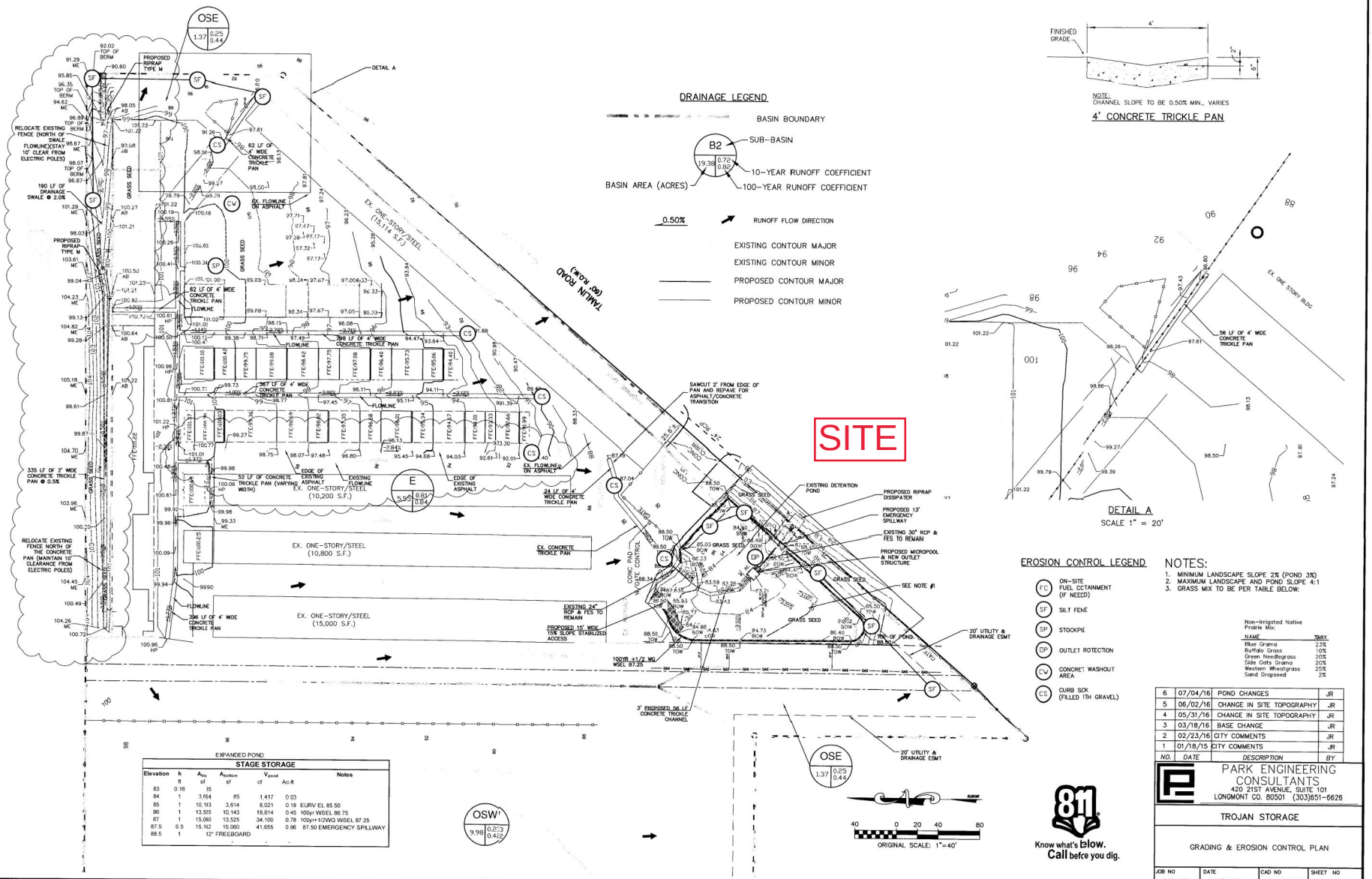
NO.	DATE	DESCRIPTION	BY
4	07/04/16	POND CHANGES	JR
3	03/18/16	BASE CHANGE	JR
2	02/23/16	CITY COMMENTS	JR
1	01/18/15	CITY COMMENTS	JR

PARK ENGINEERING CONSULTANTS
420 21ST AVENUE, SUITE 101
LONGMONT CO. 80501 (303)651-6626

TROJAN STORAGE

COVER SHEET

JOB NO	DATE	CAD NO	SHEET NO
246-67	12/14/15	24667BASE	1 OF 4



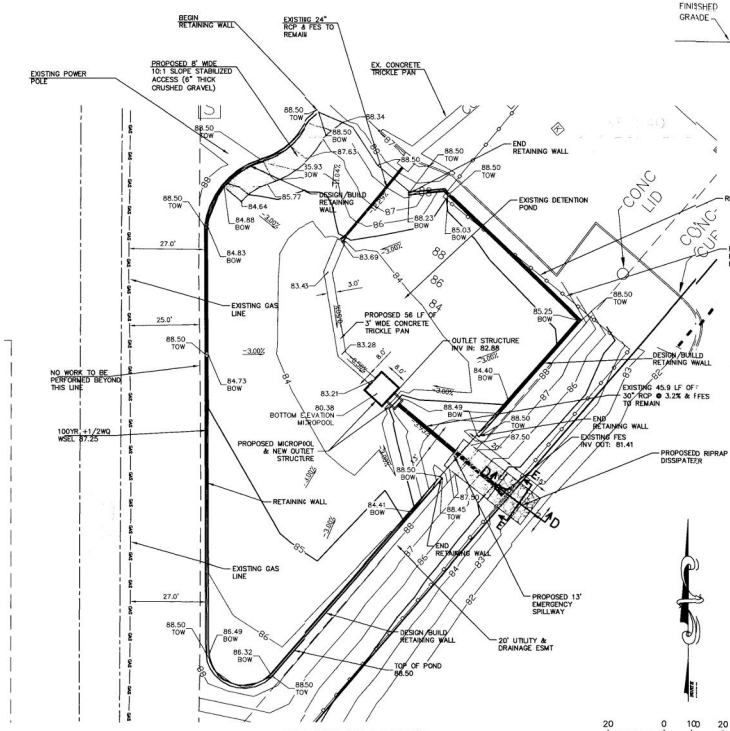
NO.	DATE	DESCRIPTION	BY
6	07/04/16	POND CHANGES	JR
5	06/02/16	CHANGE IN SITE TOPOGRAPHY	JR
4	05/31/16	CHANGE IN SITE TOPOGRAPHY	JR
3	03/18/16	BASE CHANGE	JR
2	02/23/16	CITY COMMENTS	JR
1	01/18/15	CITY COMMENTS	JR

PARK ENGINEERING CONSULTANTS
420 21ST AVENUE, SUITE 101
LONGMONT CO. 80501 (303)651-6626

TROJAN STORAGE

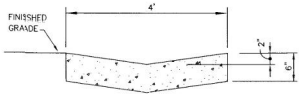
GRADING & EROSION CONTROL PLAN

JOB NO	DATE	CAD NO	SHEET NO
246-67	12/14/15	24667BASE	2 OF 4

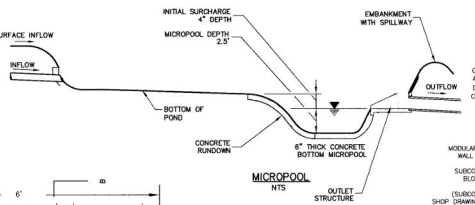


DETENTION POND

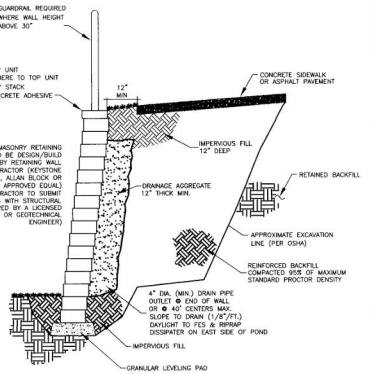
ORIGINAL SCALE: 1"=20'



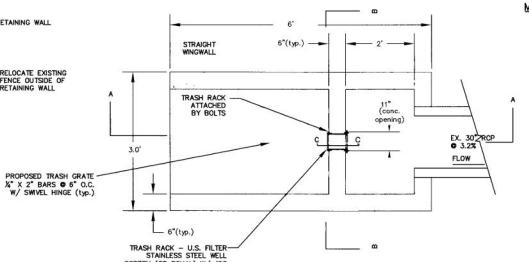
3' CONCRETE TRICKLE PAN



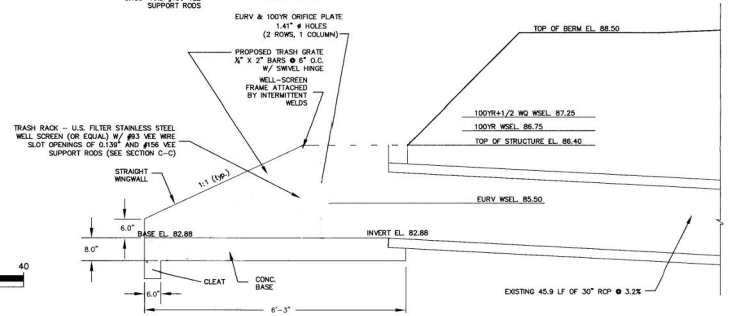
MICROPOOL
NTS



TYPICAL SECTION–DRY STACK RETAINING WALL
MODULAR CONCRETE UNIT
SCALE: NONE



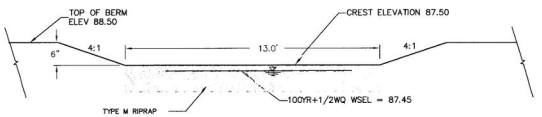
PLAN VIEW



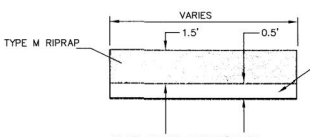
SECTION A–A

DRAINAGE LEGEND

0.50%	RUNOFF FLOW DIRECTION
	EXISTING CONTOUR MAJOR
	EXISTING CONTOUR MINOR
	PROPOSED CONTOUR MAJOR
	PROPOSED CONTOUR MINOR

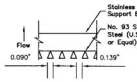


EMERGENCY SPIILLWAY
N.T.S

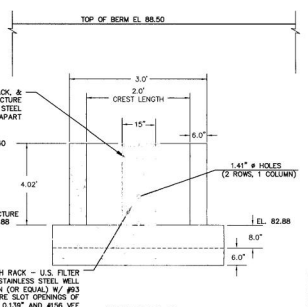


** NO FABRIC, ONLY 6" SAND BEDDING IN/FOR SUMP AREA **

EXPOSED RIPRAP DETAIL
N.T.S.

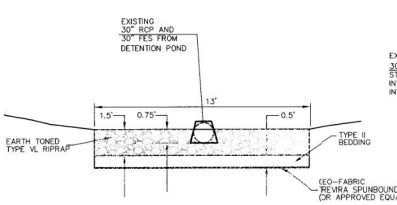


SECTION C–C

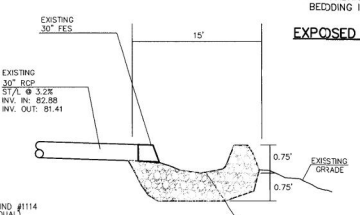


SECTION B–B

NOTES:
1. MINIMUM LANDSCAPE AND POND SLOPE 2%
2. MAXIMUM LANDSCAPE AND POND SLOPE 4:1

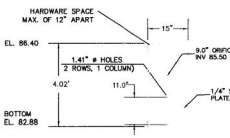


SECTION E–E
N.T.S.



SECTION D–D
N.T.S.

POND OUTFALL FLOW SPREADER DETAIL
N.T.S.



WQ. EURV & 100YR ORIFICE PLATE DETAIL

DETENTION POND
WATER QUALITY CONTROL OUTLET STRUCTURE
N.T.S

Know what's below. Call before you dig.

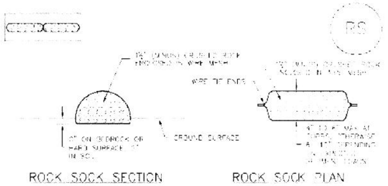
NO.	DATE	DESCRIPTION	BY
6	07/04/16	POND CHANGES	JR
5	06/13/16	REVISED POND	JR
4	06/09/16	REVISED POND	JR
3	03/18/16	BASE CHANGE	JR
2	02/23/16	CITY COMMENTS	JR
1	01/18/15	CITY COMMENTS	JR

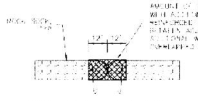
PARK ENGINEERING CONSULTANTS
420 21ST AVENUE, SUITE 101
LONGMONT CO. 80501 (303)651-6626

TROJAN STORAGE

DETENTION POND DETAILS

JOB NO	DATE	CAD NO	SHEET NO
246-67	12/14/15	24667BASE	3 OF 4





ROCK SOCK INSTALLATION NOTES

RS-1. ROCK SOCK PERIMETER CONTROL

CS CURB SOCK

ROCK SOCK MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. ROCK SOCKS SHALL BE REPLACED IF THEY BECOME HEAVILY SOILED, OR DAMAGED BEYOND REPAIR.

5. SEDIMENT ACCUMULATED UPSTREAM OF ROCK SOCKS SHALL BE REMOVED AS NEEDED TO MAINTAIN FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY ½ OF THE HEIGHT OF THE ROCK SOCK.

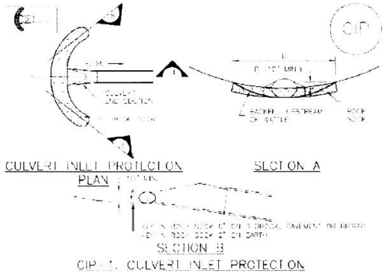
6. ROCK SOCKS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

7. WHEN ROCK SOCKS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

NOTE: THE DETAILS INCLUDED WITH THIS FACT SHEET SHOW COMMONLY USED, CONVENTIONAL METHODS OF ROCK SOCK INSTALLATION IN THE DENVER METROPOLITAN AREA. THERE ARE MANY OTHER SIMILAR PROPRIETARY PRODUCTS ON THE MARKET. UDFCD NEITHER ENDORSES NOR DISCOURAGES USE OF PROPRIETARY PROTECTION PRODUCTS; HOWEVER, IN THE EVENT PROPRIETARY METHODS ARE USED, THE APPROPRIATE DETAIL FROM THE MANUFACTURER MUST BE INCLUDED IN THE SWMP AND THE BMP MUST BE INSTALLED AND MAINTAINED AS SHOWN IN THE MANUFACTURER'S DETAILS.



CIP-1. CULVERT INLET PROTECTION

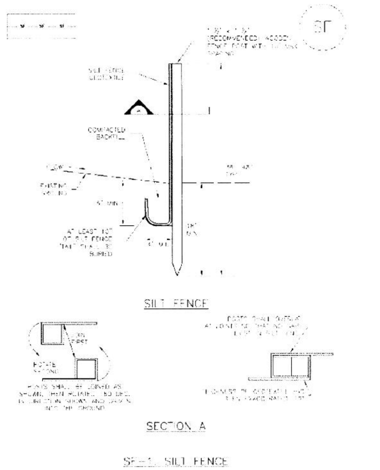
CULVERT INLET PROTECTION INSTALLATION NOTES

CULVERT INLET PROTECTION MAINTENANCE NOTES

IP INLET PROTECTION

GENERAL INLET PROTECTION INSTALLATION NOTES

INLET PROTECTION MAINTENANCE NOTES

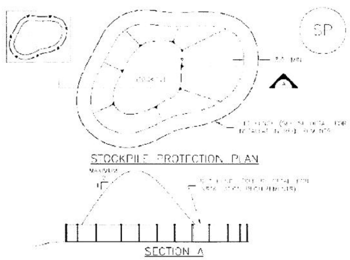


SF-1. SILT FENCE

SF SILT FENCE

SILT FENCE INSTALLATION NOTES

SILT FENCE MAINTENANCE NOTES



SP-1. STOCKPILE PROTECTION

STOCKPILE PROTECTION INSTALLATION NOTES

SP STOCKPILE PROTECTION

STOCKPILE PROTECTION MAINTENANCE NOTES

NO.	DATE	DESCRIPTION	BY
6	07/04/16	POND CHANGES	JR
2	02/23/16	CITY COMMENTS	JR
1	01/18/15	CITY COMMENTS	JR

PARK ENGINEERING CONSULTANTS
420 21ST AVENUE, SUITE 101
LONGMONT CO. 80501 (303)651-6626

TROJAN STORAGE

EROSION CONTROL DETAILS

JOB NO	DATE	CAD NO	SHEET NO
246-67	12/14/15	24667BASE	4 OF 4

Appendix C
Hydrologic Calculations

EX. DRAINAGE CALCS

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX1	6.43	2%	0.05	0.36	13.4	1.2	14.3
EX2	10.08	2%	0.05	0.36	15.4	1.8	21.2

DESIGN POINT SUMMARY TABLE

Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
1	1.2	14.3
2	1.8	21.2

EX. COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: TAMLIN ROAD STORAGE YARD
Location: Colorado Springs

Project Name: TAMLIN ROAD STORAGE YARD
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 11/1/19

Basin ID	Total Area (ac)	Historic Flow Analysis			Roofs			Paved Roads			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
EX1	6.43	2%	6.43	2.0%	90%	0.00	0.0%	100%	0.00	0.0%	2.0%
EX2	10.08	2%	10.08	2.0%	90%	0.00	0.0%	100%	0.00	0.0%	2.0%
TOTAL	16.51										2.0%

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

EX. COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: TAMLIN ROAD STORAGE YARD
Location: Colorado Springs

Project Name: TAMLIN ROAD STORAGE YARD
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 11/1/19

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Land Use			Minor Coefficients			Major Coefficients			Basins Total Weighted C_5	Basins Total Weighted C_{100}
			Area A (ac)	Area B (ac)	Area C/D (ac)	Area Historic (ac)	Area Roofs (ac)	Area Paved Roads (ac)	$C_{5,A,HISTORIC}$	$C_{5,A,ROOFS}$	$C_{5,A,ROADS}$	$C_{100,A,HISTORIC}$	$C_{100,A,ROOFS}$	$C_{100,A,ROADS}$		
EX1	6.43	2.0%	6.43	0.00	0.00	6.43	0.00	0.00	0.05	0.73	0.90	0.36	0.81	0.96	0.05	0.36
EX2	10.08	2.0%	10.08	0.00	0.00	10.08	0.00	0.00	0.05	0.73	0.90	0.36	0.81	0.96	0.05	0.36
TOTAL	16.51	2.0%	16.51	0.00	0.00	16.51	0.00	0.00	---	---	---	---	---	---	0.05	0.36

EX. STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: TAMLIN ROAD STORAGE YARD
Location: Colorado Springs

Project Name: TAMLIN ROAD STORAGE YARD
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 11/1/19

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
EX1	6.43	A	2%	0.05	0.36	54	3.5%	9.2	550	4.7%	10.0	2.2	4.2	13.4	604.0	30.2	13.4
EX2	10.08	A	2%	0.05	0.36	76	3.9%	10.5	537	3.4%	10.0	1.8	4.9	15.4	613.0	30.9	15.4

NOTES:

$$t_c = t_i + t_t$$ Equation 6-2

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$ Equation 6-5

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

EX. STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

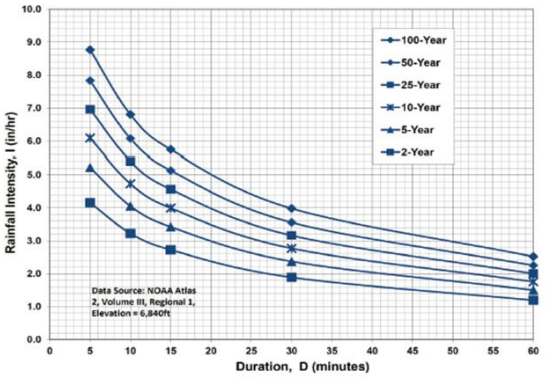
Subdivision: TAMLIN ROAD STORAGE YARD
Location: Colorado Springs
Design Storm: 5-Year

Project Name: TAMLIN ROAD STORAGE YARD
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 11/1/19

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	EX1	6.43	0.05	13.4	0.32	3.69	1.2															TOTAL FLOW DISCHARGING TO TAMLIN ROAD
	2	EX2	10.08	0.05	15.4	0.50	3.48	1.7															TOTAL FLOW DISCHARGING OFFSITE TO UNDEVELOPED LAND

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_5 = -1.50 \ln(D) + 7.583$

$I_2 = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

EX. STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: TAMLIN ROAD STORAGE YARD
Location: Colorado Springs
Design Storm: 100-Year

Project Name: TAMLIN ROAD STORAGE YARD
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 11/1/19

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	EX1	6.43	0.36	13.4	2.31	6.19	14.3															TOTAL FLOW DISCHARGING TO TAMLIN ROAD
	2	EX2	10.08	0.36	15.4	3.63	5.84	21.2															TOTAL FLOW DISCHARGING OFFSITE ALONG WESTERN PROPERTY LINE TO UNDEVELOPED PARCEL

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

TAMLIN ROAD RV & BOAT STORAGE - PROPOSED DRAINAGE CALCS

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	0.09	33%	0.35	0.55	5.0	0.2	0.4
A2	4.05	74%	0.71	0.81	6.8	13.5	26.0
A3	4.72	81%	0.78	0.86	8.5	16.0	30.0
A4	0.70	0%	0.08	0.35	7.0	0.3	1.9
A5	1.84	9%	0.15	0.40	8.5	1.2	5.5
A6	0.22	0%	0.08	0.35	5.0	0.1	0.7
A7	0.39	0%	0.08	0.35	5.0	0.2	1.2
A8	0.40	0%	0.08	0.35	5.0	0.2	1.2
E	5.55	86%	0.79	0.84	n/a	n/a	5.6

DESIGN POINT SUMMARY TABLE		
DP#	Q_5 (cfs)	Q_{100} (cfs)
1	0.2	0.4
2	28.7	54.6
3	28.8	56.3
4	1.2	11.0
5	0.1	0.7
6	0.2	1.2
7	0.2	1.2
E1	n/a	5.6

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: TAMLIN ROAD RV STORAGE
Location: Colorado Springs

Project Name: TAMLIN ROAD RV STORAGE
Project No.: 25134.00
Calculated By: RPD
Checked By:
Date: 5/27/20

Basin ID	Total Area (ac)	Paved Roads (Asphalt)			Rock Mulch			Lawns			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
A1	0.09	100%	0.03	33.3%	20%	0.00	0.0%	0%	0.06	0.0%	33.3%
A2	4.05	100%	2.92	72.1%	20%	0.29	1.4%	0%	0.84	0.0%	73.5%
A3	4.72	100%	3.74	79.2%	20%	0.38	1.6%	0%	0.60	0.0%	80.8%
A4	0.70	100%	0.00	0.0%	20%	0.00	0.0%	0%	0.70	0.0%	0.0%
A5	1.84	100%	0.16	8.7%	20%	0.00	0.0%	0%	1.68	0.0%	8.7%
A6	0.22	100%	0.00	0.0%	20%	0.00	0.0%	0%	0.22	0.0%	0.0%
A7	0.39	100%	0.00	0.0%	20%	0.00	0.0%	0%	0.39	0.0%	0.0%
A8	0.40	100%	0.00	0.0%	20%	0.00	0.0%	0%	0.40	0.0%	0.0%
TOTAL	12.41										56%
POND A TOTAL	9.56									POND A	71%

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: TAMLIN ROAD RV STORAGE
Location: Colorado Springs

Project Name: TAMLIN ROAD RV STORAGE
Project No.: 25134.00
Calculated By: RPD
Checked By:
Date: 5/27/20

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Land Use			Minor Coefficients			Major Coefficients			Basins Total Weighted C_5	Basins Total Weighted C_{100}
			Area A (ac)	Area B (ac)	Area C/D (ac)	Area Roads (ac)	Area Rock Mulch (ac)	Area Lawns (ac)	$C_{5,A,ROADS}$	$C_{5,A,ROCK\ MULCH}$	$C_{5,A,\ LAWNS}$	$C_{100,A.\ ROADS}$	$C_{100,A,ROCK\ MULCH}$	$C_{100,A,\ LAWNS}$		
A1	0.09	33.3%	0.09	0.00	0.00	0.03	0.00	0.06	0.90	0.21	0.08	0.96	0.37	0.35	0.35	0.55
A2	4.05	73.5%	4.05	0.00	0.00	2.92	0.29	0.84	0.90	0.58	0.08	0.96	0.68	0.35	0.71	0.81
A3	4.72	80.8%	4.72	0.00	0.00	3.74	0.38	0.60	0.90	0.66	0.08	0.96	0.74	0.35	0.78	0.86
A4	0.70	0.0%	0.70	0.00	0.00	0.00	0.00	0.70	0.90	0.00	0.08	0.96	0.11	0.35	0.08	0.35
A5	1.84	8.7%	1.84	0.00	0.00	0.16	0.00	1.68	0.90	0.04	0.08	0.96	0.18	0.35	0.15	0.40
A6	0.22	0.0%	0.22	0.00	0.00	0.00	0.00	0.22	0.90	0.00	0.08	0.96	0.11	0.35	0.08	0.35
A7	0.39	0.0%	0.39	0.00	0.00	0.00	0.00	0.39	0.90	0.00	0.08	0.96	0.11	0.35	0.08	0.35
A8	0.40	0.0%	0.40	0.00	0.00	0.00	0.00	0.40	0.90	0.00	0.08	0.96	0.11	0.35	0.08	0.35
TOTAL	12.41	56.3%	12.41	0.00	0.00	6.85	0.24	4.89	---	---	---	---	---	---	0.56	0.71

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.84i^{1.124}$	$C_A = 0.85i+0.025$	$C_A = 0.78i+0.110$	$C_A = 0.65i+0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i+0.057$	$C_B = 0.63i+0.249$	$C_B = 0.56i+0.328$	$C_B = 0.47i+0.426$	$C_B = 0.37i+0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i+0.035$	$C_{C/D} = 0.74i+0.132$	$C_{C/D} = 0.56i+0.319$	$C_{C/D} = 0.49i+0.393$	$C_{C/D} = 0.41i+0.484$	$C_{C/D} = 0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

TABLE 6-4 UTILIZED TO CALCULATE 'C-VALUE' FOR ROCK MULCH

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: TAMLIN ROAD RV STORAGE
Location: Colorado Springs

Project Name: TAMLIN ROAD RV STORAGE
Project No.: 25134.00
Calculated By: RPD
Checked By:
Date: 5/27/20

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
A1	0.09	A	33%	0.35	0.55	11	2.0%	3.6	250	2.9%	20.0	3.4	1.2	4.8	261.0	22.1	5.0
A2	4.05	A	74%	0.71	0.81	125	5.6%	4.5	455	2.7%	20.0	3.3	2.3	6.8	580.0	15.9	6.8
A3	4.72	A	81%	0.78	0.86	105	1.0%	5.9	517	2.8%	20.0	3.3	2.6	8.5	622.0	14.8	8.5
A4	0.70	A	0%	0.08	0.35	25	25.0%	3.2	160	1.0%	7.0	0.7	3.8	7.0	185.0	29.0	7.0
A5	1.84	A	9%	0.15	0.40	37	5.2%	6.0	275	7.4%	7.0	1.9	2.4	8.5	312.0	26.2	8.5
A6	0.22	A	0%	0.08	0.35	20	22.0%	3.0	25	22.0%	7.0	3.3	0.1	3.1	45.0	26.1	5.0
A7	0.39	A	0%	0.08	0.35	20	25.0%	2.8	25	25.0%	7.0	3.5	0.1	3.0	45.0	26.1	5.0
A8	0.40	A	0%	0.08	0.35	20	18.0%	3.2	25	18.0%	7.0	3.0	0.1	3.3	45.0	26.1	5.0

NOTES:

$$t_c = t_i + t_t$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

Equation 6-2

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

Equation 6-5

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Equation 6-3

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: TAMLIN ROAD RV STORAGE
Location: Colorado Springs
Design Storm: 5-Year

Project Name: TAMLIN ROAD RV STORAGE
Project No.: 25134.00
Calculated By: RPD
Checked By:
Date: 5/27/20

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	E1	E	5.55	0.81	n/a	n/a	n/a	n/a															BASIN E POND OVERFLOW @ DPE1, SWALE ROUTES FLOW TO DP4
	1	A1	0.09	0.35	5.0	0.03	5.17	0.2					0.2	0.03	2.0					406	2.8	2.4	BASIN A1 FLOW @ DP1, SHEET FLOW TO DP2
		A2	4.05	0.71	6.8	2.86	4.71	13.5															BASIN A2 FLOW @ DP2 (ROUTED IN SF2)
		A3	4.72	0.78	8.5	3.66	4.37	16.0															BASIN A3 FLOW @ DP2 (ROUTED IN SF2)
	2								8.5	6.55	4.37	28.7	28.7	6.55	25.0					35	10.0	0.1	DP1, BASIN A2-A3 FLOW @ DP2, SHEET FLOW TO DP3 (F.S.D. WQ POND)
		A4	0.70	0.08	7.0	0.06	4.67	0.3															BASIN A4 FLOW @ DP3 (ROUTED IN SF2)
	3								8.5	6.61	4.36	28.8											TOTAL BASIN A1-A4 FLOW ENTERING F.S.D. WQ POND
	4	A5	1.84	0.15	8.5	0.28	4.38	1.2															TOTAL BASIN A5 (UNDEVELOPED) FLOW AND BASIN E POND OVERFLOW, SWALE DISCHARGES OFFSITE THRU LOW-TAILWATER BASIN
	5	A6	0.22	0.08	5.0	0.02	5.17	0.1															TOTAL BASIN A6 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS
	6	A7	0.39	0.08	5.0	0.03	5.17	0.2															TOTAL BASIN A7 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS
	7	A8	0.40	0.08	5.0	0.03	5.17	0.2															TOTAL BASIN A8 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: TAMLIN ROAD RV STORAGE
Location: Colorado Springs
Design Storm: 100-Year

Project Name: TAMLIN ROAD RV STORAGE
Project No.: 25134.00
Calculated By: RPD
Checked By:
Date: 5/27/20

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	E1	E	5.55	0.84	n/a	n/a	n/a	5.6															BASIN E POND OVERFLOW @ DPE1, SWALE ROUTES FLOW TO DP4
	1	A1	0.09	0.55	5.0	0.05	8.68	0.4					0.4	0.05	2.0					406	2.8	2.4	BASIN A1 FLOW @ DP1, SHEET FLOW TO DP2
		A2	4.05	0.81	6.8	3.30	7.90	26.1															BASIN A2 FLOW @ DP2 (ROUTED IN SF2)
		A3	4.72	0.86	8.5	4.08	7.34	30.0															BASIN A3 FLOW @ DP2 (ROUTED IN SF2)
	2								8.5	7.43	7.34	54.6	54.6	7.43	25.0					35	10.0	0.1	DP1, BASIN A2-A3 FLOW @ DP2, SHEET FLOW TO DP3 (F.S.D. WQ POND)
		A4	0.70	0.35	7.0	0.25	7.83	2.0															BASIN A4 FLOW @ DP3 (ROUTED IN SF2)
	3								8.5	7.68	7.33	56.3											TOTAL BASIN A1-A4 FLOW ENTERING F.S.D. WQ POND
	4	A5	1.84	0.40	8.5	0.74	7.36	5.4	n/a	n/a	n/a	11.0											TOTAL BASIN A5 (UNDEVELOPED) FLOW AND BASIN E POND OVERFLOW, SWALE DISCHARGES OFFSITE THRU LOW-TAILWATER BASIN
	5	A6	0.22	0.35	5.0	0.08	8.68	0.7															TOTAL BASIN A6 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS
	6	A7	0.39	0.35	5.0	0.14	8.68	1.2															TOTAL BASIN A7 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS
	7	A8	0.40	0.35	5.0	0.14	8.68	1.2															TOTAL BASIN A8 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	1.19	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer: RPD
Company: JR ENGINEERING
Date: May 27, 2020
Project: TAMLIN ROAD RV & BOAT STORAGE
Location: COLORADO SPRINGS

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	A1	A2	A3	A4										
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam										
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0.085	4.050	4.622	0.699										
Directly Connected Impervious Area (DCIA, acres)	0.000	2.406	3.230	0.000										
Unconnected Impervious Area (UIA, acres)	0.024	0.571	0.551	0.000										
Receiving Pervious Area (RPA, acres)	0.061	0.625	0.251	0.000										
Separate Pervious Area (SPA, acres)	0.000	0.448	0.590	0.699										
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	V										

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	0.085	4.050	4.622	0.699										
Directly Connected Impervious Area (DCIA, %)	0.0%	59.4%	69.9%	0.0%										
Unconnected Impervious Area (UIA, %)	28.2%	14.1%	11.9%	0.0%										
Receiving Pervious Area (RPA, %)	71.8%	15.4%	5.4%	0.0%										
Separate Pervious Area (SPA, %)	0.0%	11.1%	12.8%	100.0%										
A_R (RPA / UIA)	2.542	1.095	0.456	0.000										
I_a Check	0.280	0.480	0.690	1.000										
f / I for WQCV Event:	0.9	0.9	0.9	0.9										
f / I for 5-Year Event:	0.5	0.5	0.5	0.5										
f / I for 100-Year Event:	0.3	0.3	0.3	0.3										
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	0.76	0.81	0.86	0.00										
IRF for 5-Year Event:	0.86	0.89	0.93	1.00										
IRF for 100-Year Event:	0.90	0.93	0.96	1.00										
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}	28.2%	73.5%	81.8%	0.0%										
Effective Imperviousness for WQCV Event:	21.5%	70.8%	80.1%	0.0%										
Effective Imperviousness for 5-Year Event:	24.3%	72.0%	80.9%	0.0%										
Effective Imperviousness for 100-Year Event:	25.4%	72.5%	81.3%	0.0%										
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	16.6%	4.5%	3.2%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	10.4%	1.3%	0.6%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	71.7%
Total Site Effective Imperviousness for WQCV Event:	69.7%
Total Site Effective Imperviousness for 5-Year Event:	70.6%
Total Site Effective Imperviousness for 100-Year Event:	71.0%
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.
** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

Appendix D
Hydraulic Calculations

Weir Report

Pond A Spillway (Q_100 = 34.4 cfs (Per UD-Detention Peak Inflow))

Trapezoidal Weir

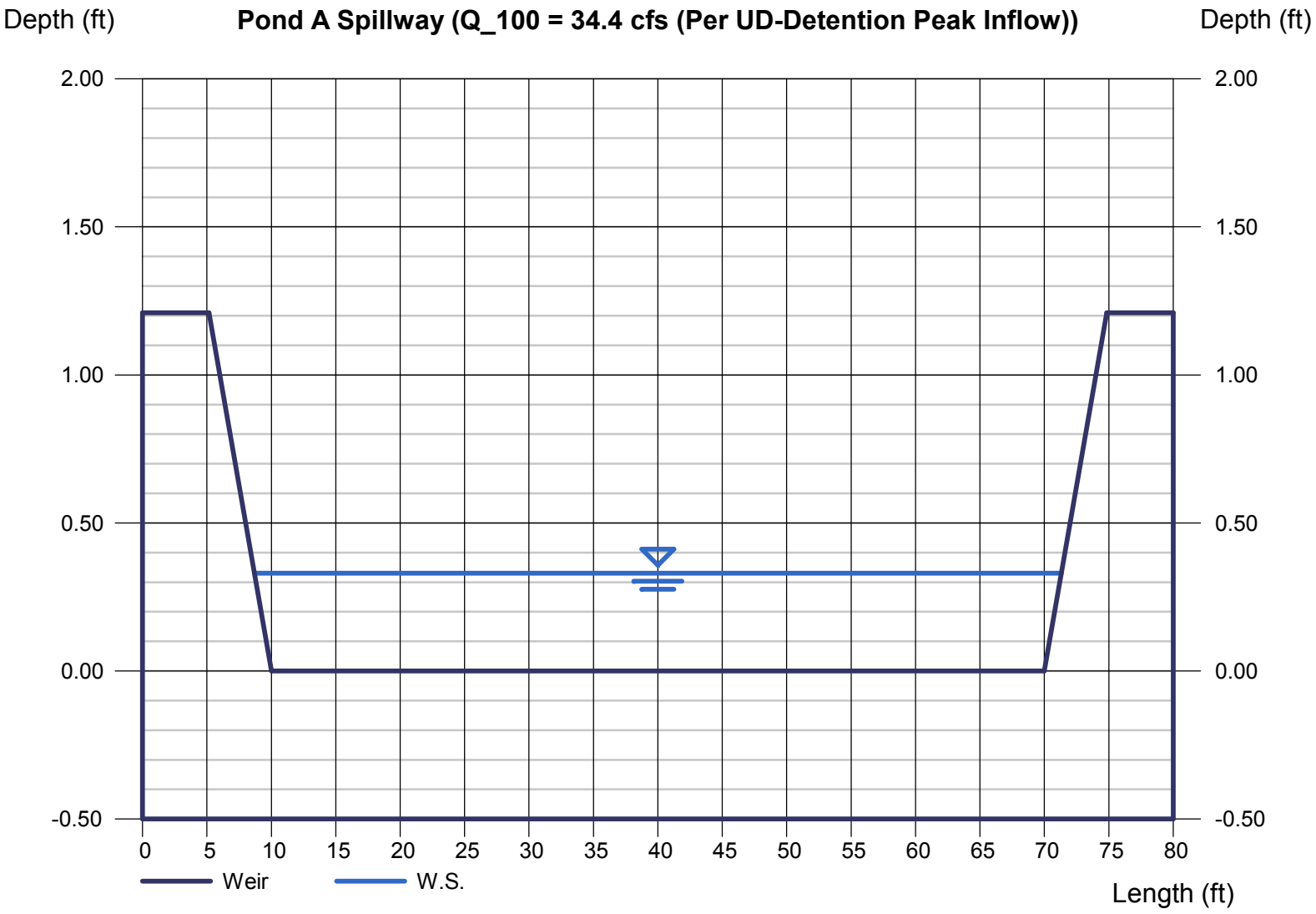
Crest	= Sharp
Bottom Length (ft)	= 60.00
Total Depth (ft)	= 1.21
Side Slope (z:1)	= 4.00

Calculations

Weir Coeff. Cw	= 3.10
Compute by:	Known Q
Known Q (cfs)	= 34.40

Highlighted

Depth (ft)	= 0.33
Q (cfs)	= 34.40
Area (sqft)	= 20.24
Velocity (ft/s)	= 1.70
Top Width (ft)	= 62.64



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Aug 18 2020

Pond A Spillway Channel Q100 = 34.4cfs (Per UD-Detention Peak Inflow)

Trapezoidal

Bottom Width (ft)	= 60.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.21
Invert Elev (ft)	= 5000.00
Slope (%)	= 25.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 34.40

Highlighted

Depth (ft)	= 0.12
Q (cfs)	= 34.40
Area (sqft)	= 7.26
Velocity (ft/s)	= 4.74
Wetted Perim (ft)	= 60.99
Crit Depth, Yc (ft)	= 0.22
Top Width (ft)	= 60.96
EGL (ft)	= 0.47

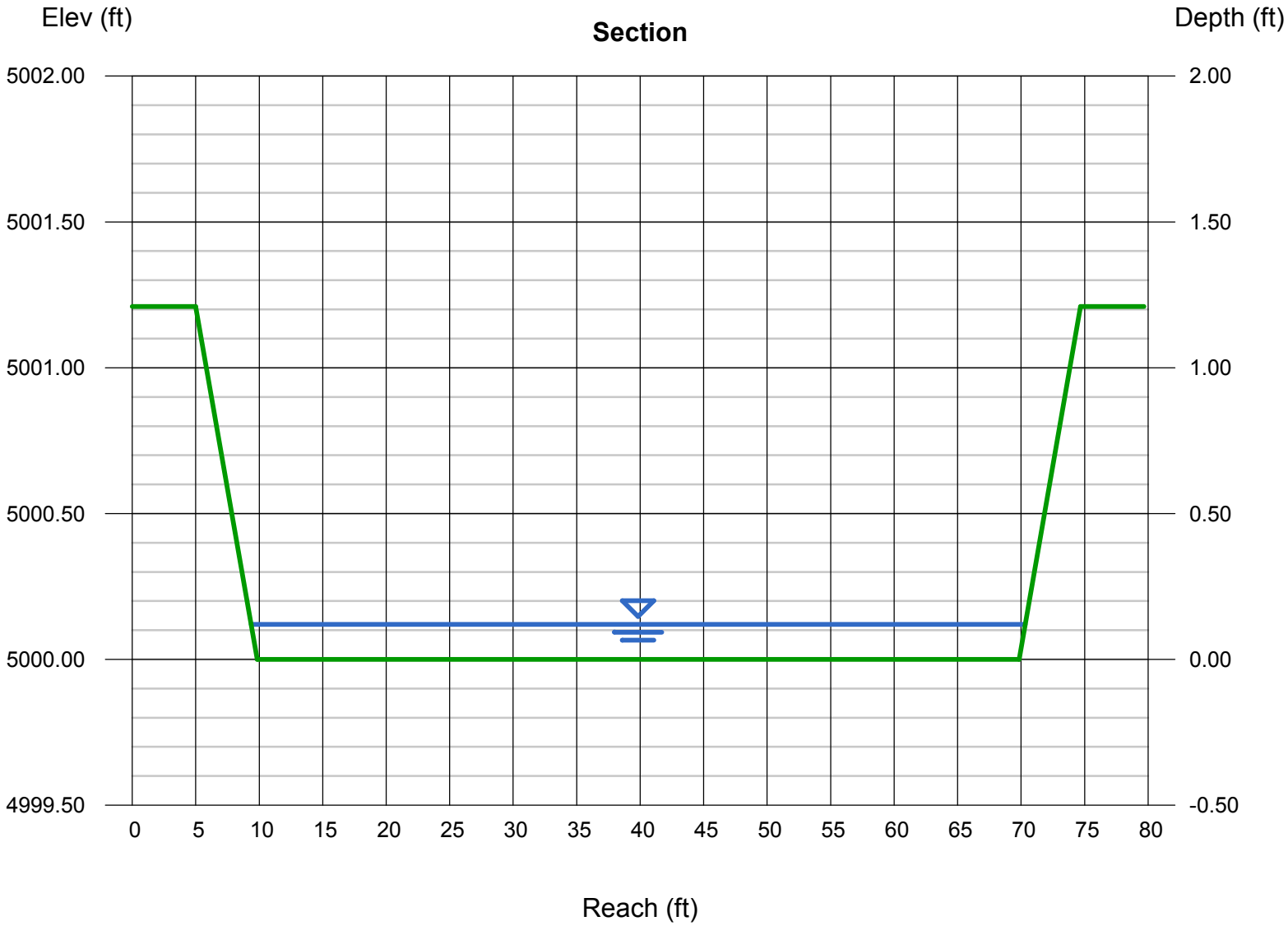


TABLE 10-4

MAXIMUM PERMISSIBLE VELOCITIES FOR EARTH CHANNELS WITH VARIED GRASS LININGS AND SLOPES

Channel Slope	Lining	Permissible Mean Channel Velocity * (ft/sec)
0 - 5%	Sodded grass	7
	Bermudagrass	6
	Reed canarygrass	5
	Tall fescue	5
	Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue	2.5
	Redtop	2.5
	Sericea lespedeza	2.5
	Annual lespedeza	2.5
	Small grains (temporary)	2.5
5 - 10%	Sodded grass	6
	Bermudagrass	5
	Reed canarygrass	4
	Tall fescue	4
	Kentucky bluegrass	4
	Grass-legume mixture	3
Greater than 10%	Sodded grass	5
	Bermudagrass	4
	Reed canarygrass	3
	Tall fescue	3
	Kentucky bluegrass	3

4.74 < 5 fps

* For highly erodible soils, decrease permissible velocities by 25%.

* Grass lined channels are dependent upon assurances of continuous growth and maintenance of grass.

Spillway Velocity with 100yr flow (34.4cfs) = 4.74fps

Channel Report

Existing Swale Downstream of Pond A (Q_100 = 20.7 cfs)

20.7 cfs = 6.6 (Pond A) + 11.0 (DP#4) + 0.7 (DP#5) + 1.2 (DP#6) + 1.2 (DP#7)

Triangular

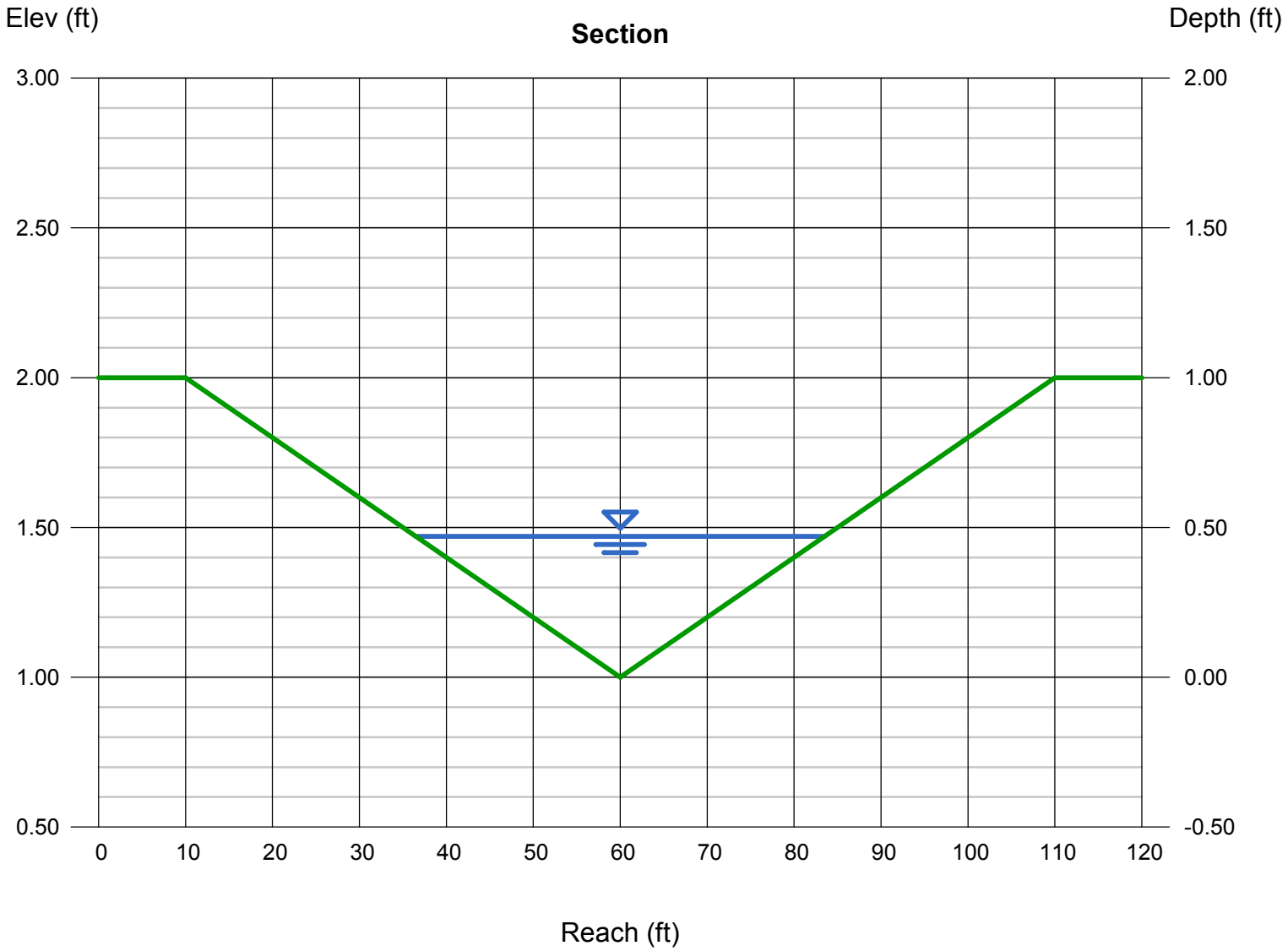
Side Slopes (z:1)	= 50.00, 50.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 20.70

Highlighted

Depth (ft)	= 0.47
Q (cfs)	= 20.70
Area (sqft)	= 11.04
Velocity (ft/s)	= 1.87
Wetted Perim (ft)	= 47.01
Crit Depth, Yc (ft)	= 0.41
Top Width (ft)	= 47.00
EGL (ft)	= 0.52



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Jul 13 2020

Riprap Rundown to Pond A at DP 2 (Q_100 = 33.0 cfs per UD_Detention Peak Inflow)

Trapezoidal

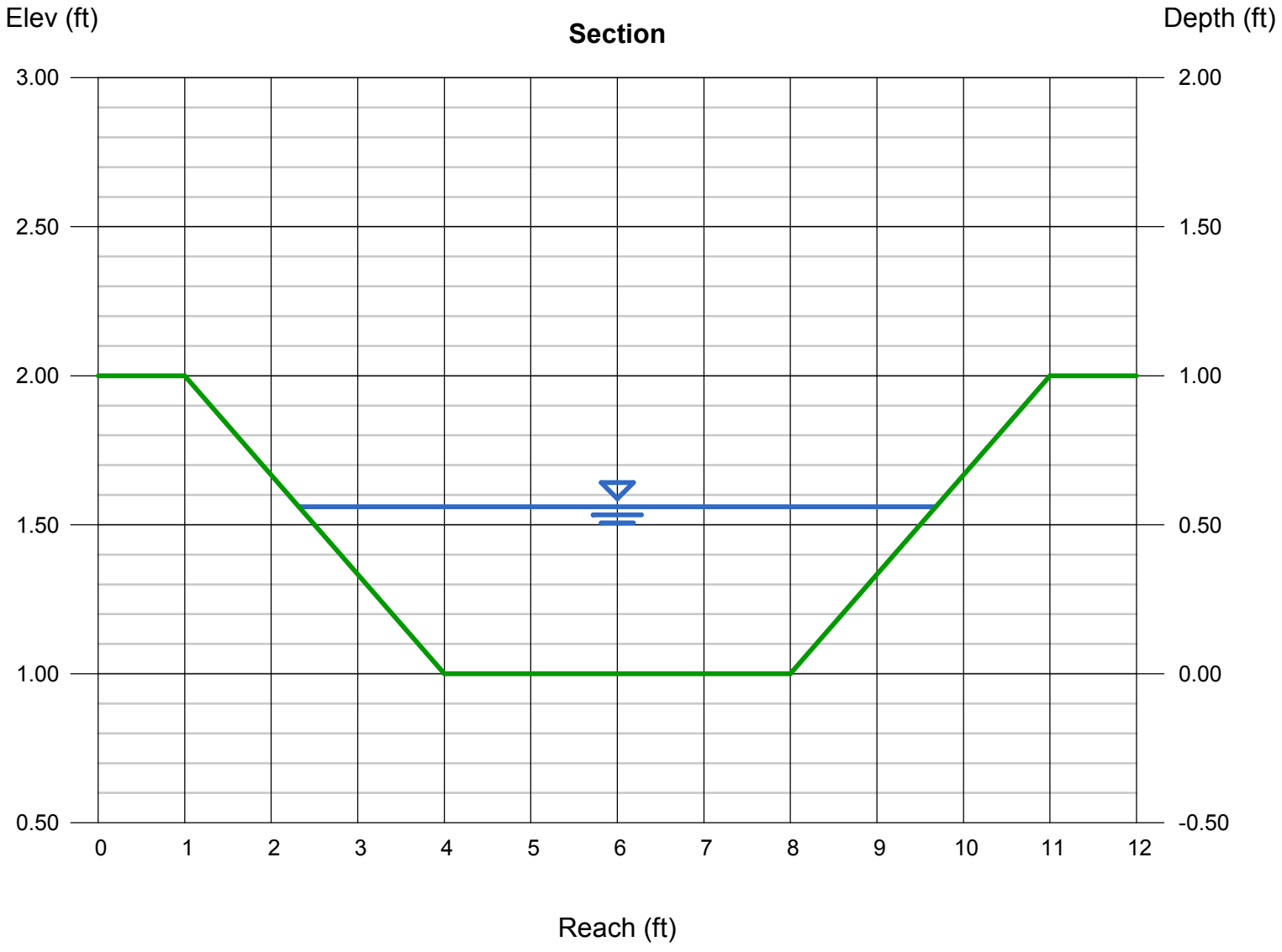
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 25.00
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 33.00

Highlighted

Depth (ft)	= 0.56
Q (cfs)	= 33.00
Area (sqft)	= 3.18
Velocity (ft/s)	= 10.37
Wetted Perim (ft)	= 7.54
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 7.36
EGL (ft)	= 2.23



Channel Riprap Sizing Calcs

Existing Channel Discharge	33	CFS
Existing Channel Bottom Width	4	FT
Channel Slope	0.2	FT/FT

for $S_{ch} \geq 0.10$ (10:1) i.e. 5:1 or 0.20 ft/ft

$$D_{50} = \left[\frac{q_t (S_{ch})^{0.58}}{3.95(10)^{-2}} \right]^{\frac{1}{1.89}}$$ (Equation 2)

qt	10.31	FT
D50	11.59	IN

Type VL (D50)	6	IN
Type L (D50)	9	IN
Type M (D50)	12	IN
Type H (D50)	18	IN
Type VH (D50)	24	IN

Use Type M Riprap for channel (D50=12")

Based on USDA's "Design procedures for rock-lined chute"
https://data.nal.usda.gov/dataset/rock-chute-design

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, May 27 2020

Basin A5 Swale (Q_100 = 11.0 cfs at DP#4)

Triangular

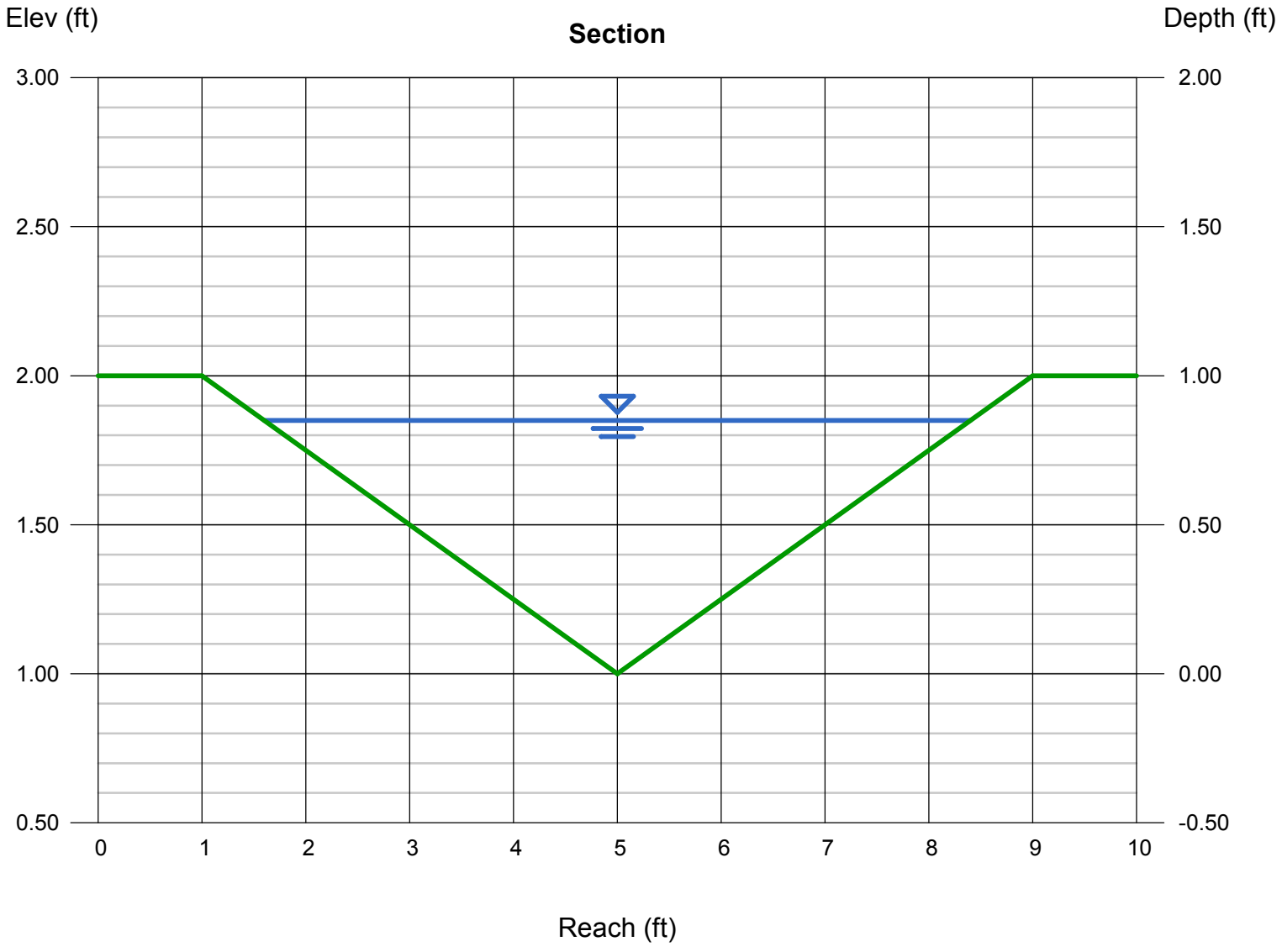
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 11.00

Highlighted

Depth (ft)	= 0.85
Q (cfs)	= 11.00
Area (sqft)	= 2.89
Velocity (ft/s)	= 3.81
Wetted Perim (ft)	= 7.01
Crit Depth, Yc (ft)	= 0.86
Top Width (ft)	= 6.80
EGL (ft)	= 1.08

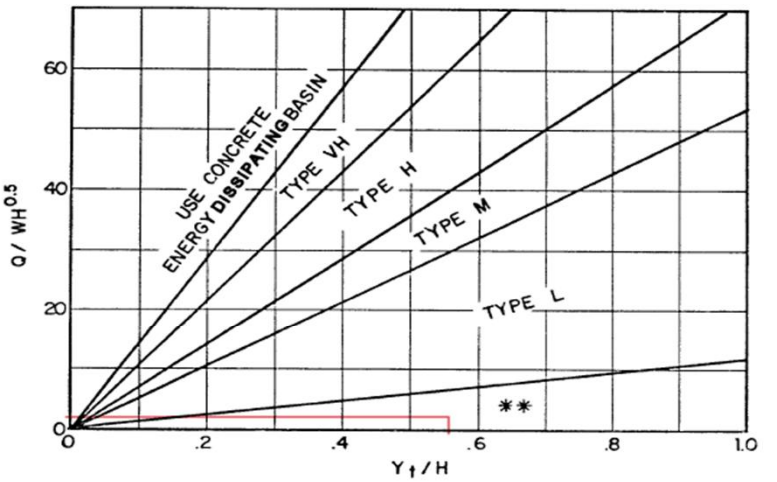


Low Tailwater Basin Riprap Sizing Calcs

Q	34.4	CFS
W	4	FT
H	1.5	FT
Yt	0.85	FT

Q/(WH^1.5)	2.24	<8.0
Q/(WH^0.5)	1.49	
Yt/H	0.56	

Use Type L Riprap for Low Tailwater Basin



Use H_a instead of H whenever culvert has supercritical flow in the barrel.
**Use Type L for a distance of 3H downstream.

Figure 9-39. Riprap erosion protection at rectangular conduit outlet (valid for Q/WH1.5 ≤ 8.0)

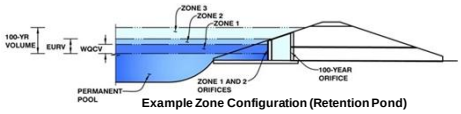
Appendix E
Water Quality and Detention

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: _____

Basin ID: _____



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	9.56	acres
Watershed Length =	713	ft
Watershed Length to Centroid =	261	ft
Watershed Slope =	0.023	ft/ft
Watershed Imperviousness =	71.70%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

		Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.225 acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.874 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.595 acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.777 acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.922 acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.102 acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.278 acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.488 acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	1.843 acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	0.571 acre-feet		
Approximate 5-yr Detention Volume =	0.745 acre-feet		
Approximate 10-yr Detention Volume =	0.894 acre-feet		
Approximate 25-yr Detention Volume =	1.069 acre-feet		
Approximate 50-yr Detention Volume =	1.173 acre-feet		
Approximate 100-yr Detention Volume =	1.275 acre-feet		

Define Zones and Basin Geometry

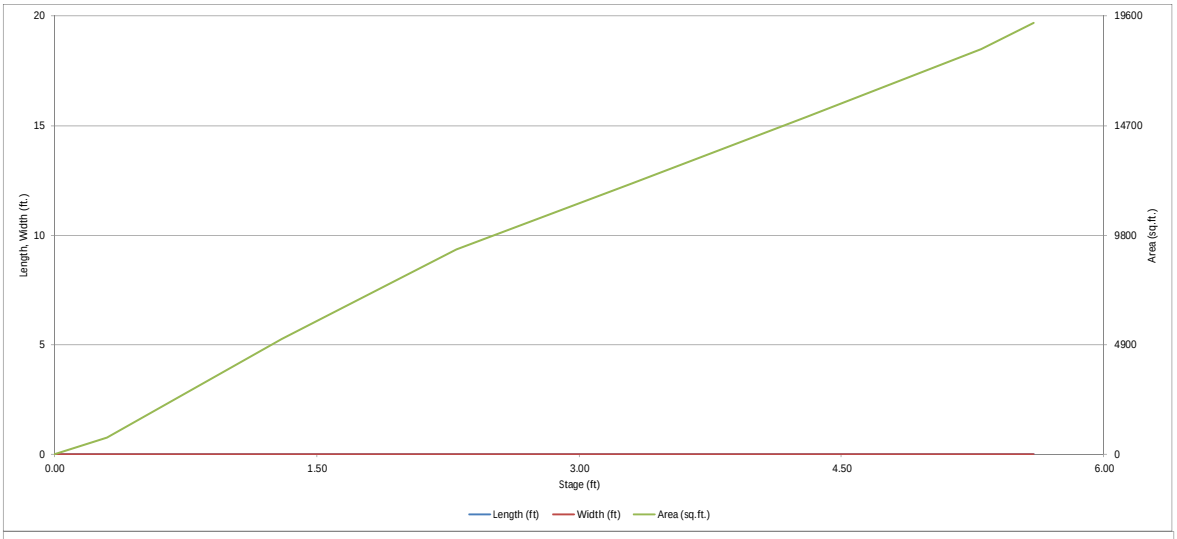
Zone 1 Volume (WQCV) =	0.225	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.649	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.401	acre-feet
Total Detention Basin Volume =	1.275	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio (R_{LW}) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

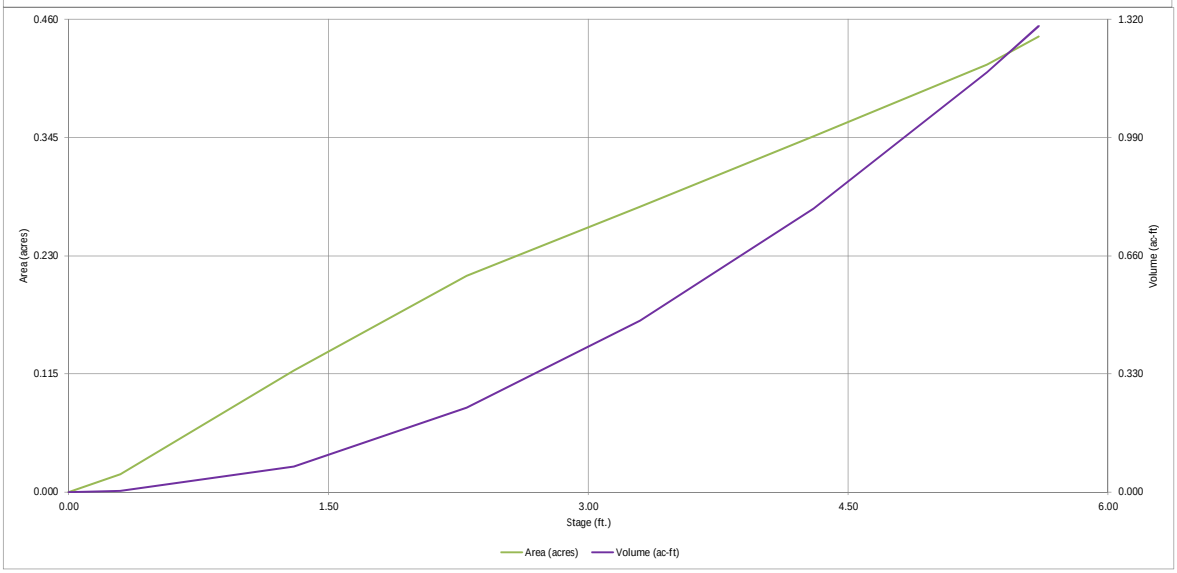
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
6716.7 Top of Micropool	--	0.00	--	--	--	0	0.000		
6717	--	0.30	--	--	--	750	0.017	112	0.003
6718	--	1.30	--	--	--	5,149	0.118	3,062	0.070
6719	--	2.30	--	--	--	9,172	0.211	10,222	0.235
6720	--	3.30	--	--	--	12,103	0.278	20,860	0.479
6721	--	4.30	--	--	--	15,085	0.346	34,454	0.791
6722	--	5.30	--	--	--	18,119	0.416	51,056	1.172
6722.3	--	5.60	--	--	--	19,309	0.443	56,670	1.301

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



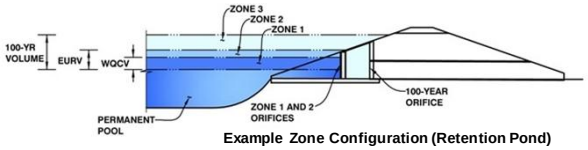


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.26	0.225	Orifice Plate
Zone 2 (EURV)	4.54	0.649	Rectangular Orifice
Zone 3 (100-year)	5.55	0.401	Weir&Pipe (Restrict)
Total (all zones)		1.275	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	2.26	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00						
Orifice Area (sq. inches)	1.23	1.23						

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected				
Invert of Vertical Orifice =	2.26	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.02	N/A ft^2
Depth at top of Zone using Vertical Orifice =	4.54	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.05	N/A feet
Vertical Orifice Height =	1.25	N/A	inches			
Vertical Orifice Width =	2.50		inches			

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected				
Overflow Weir Front Edge Height, Ho =	4.54	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.54	N/A feet
Overflow Weir Front Edge Length =	3.00	N/A	feet	Overflow Weir Slope Length =	3.00	N/A feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	2.55	N/A
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	4.50	N/A ft^2
Overflow Grate Open Area % =	50%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	1.35	N/A ft^2
Debris Clogging % =	70%	N/A	%			

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected				
Depth to Invert of Outlet Pipe =	0.95	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.77	N/A ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.75	N/A feet
Restrictor Plate Height Above Pipe Invert =	18.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.65	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.31	feet
Spillway Crest Length =	60.00	feet	Stage at Top of Freeboard =	6.96	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.44	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.30	acre-ft

Calculated Parameters for Spillway

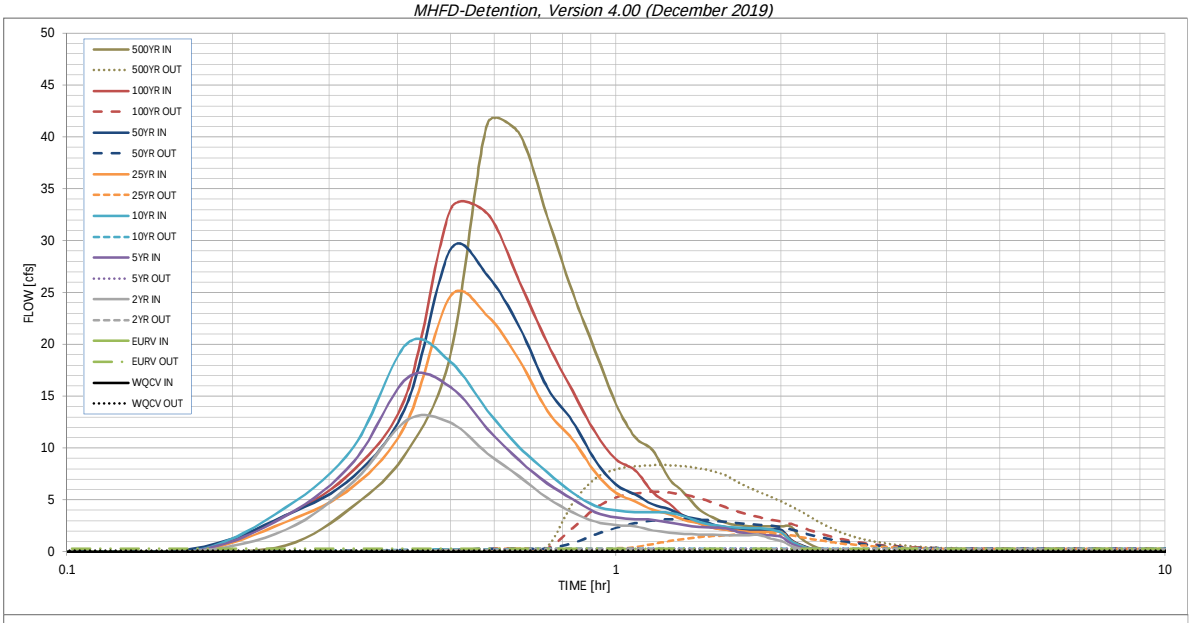
Routed Hydrograph Results

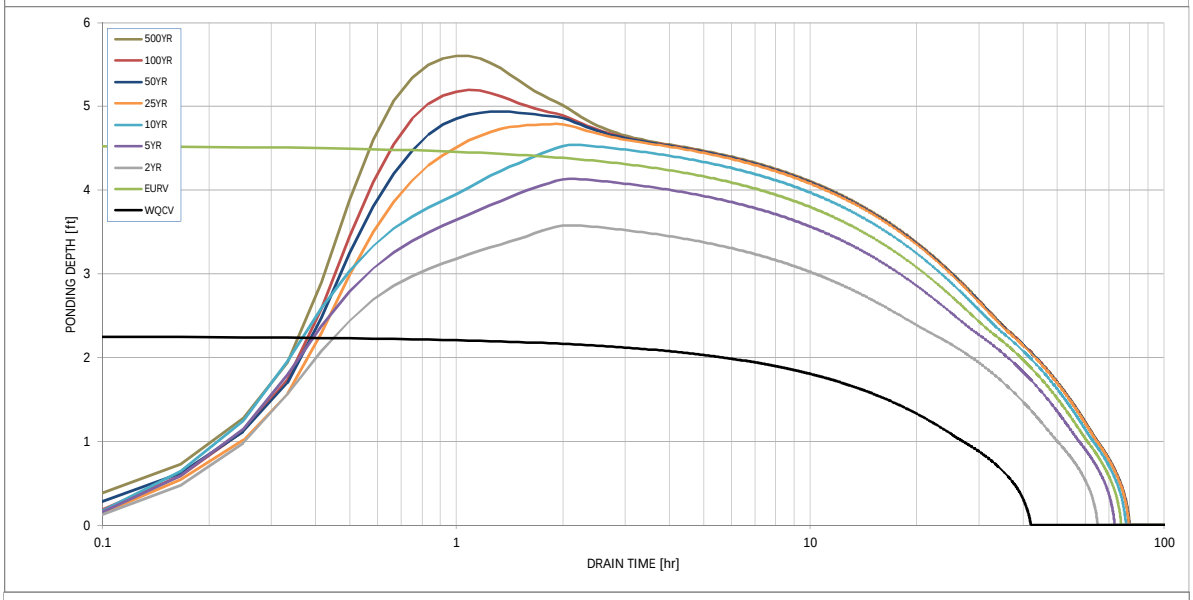
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

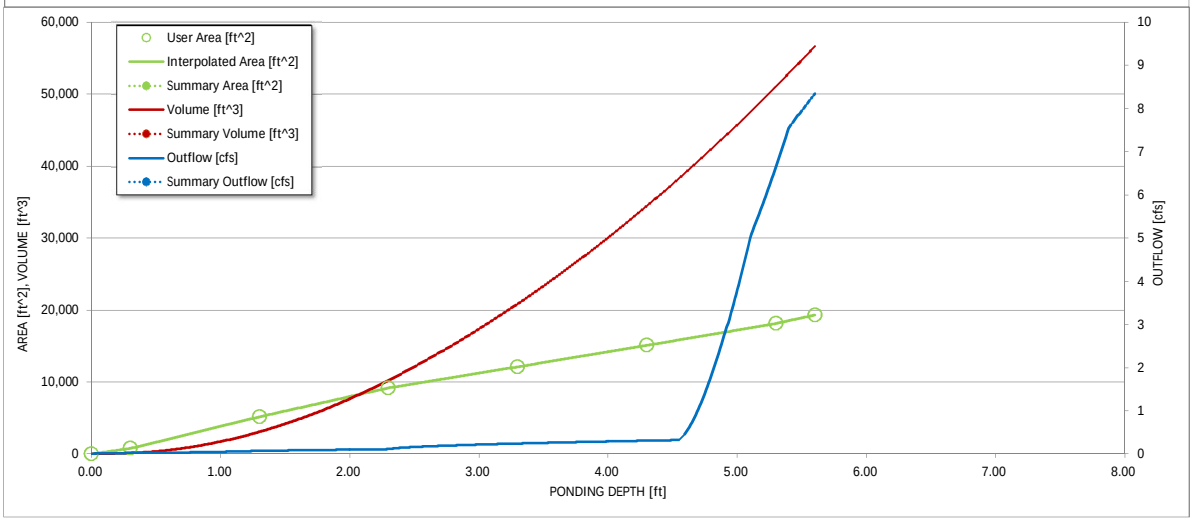
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	0.225	0.874	0.595	0.777	0.922	1.102	1.278	1.488	1.843
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.595	0.777	0.922	1.102	1.278	1.488	1.843
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.3	2.6	4.9	8.0	12.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.27	0.52	0.84	1.33
Peak Inflow Q (cfs) =	N/A	N/A	12.7	16.8	20.1	24.7	29.2	33.0	41.3
Peak Outflow Q (cfs) =	0.1	0.3	0.3	0.3	0.3	1.7	3.2	5.8	8.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.4	1.1	0.7	0.6	0.7	0.7
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.3	0.6	1.2	1.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	65	57	63	67	67	65	64	61
Time to Drain 99% of Inflow Volume (hours) =	40	71	62	68	73	74	74	73	72
Maximum Ponding Depth (ft) =	2.26	4.54	3.58	4.13	4.54	4.79	4.94	5.20	5.60
Area at Maximum Ponding Depth (acres) =	0.21	0.36	0.30	0.33	0.36	0.38	0.39	0.41	0.44
Maximum Volume Stored (acre-ft) =	0.226	0.876	0.559	0.733	0.872	0.969	1.027	1.127	1.301

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.02	0.60
	0:15:00	0.00	0.00	2.11	3.44	4.25	2.86	3.48	3.47	4.45
	0:20:00	0.00	0.00	6.82	8.72	10.17	6.35	7.31	7.94	9.66
	0:25:00	0.00	0.00	12.70	16.76	20.09	12.56	14.32	15.38	19.06
	0:30:00	0.00	0.00	12.43	15.87	18.29	24.68	29.18	33.03	41.26
	0:35:00	0.00	0.00	9.47	11.86	13.63	22.75	26.66	32.61	40.33
	0:40:00	0.00	0.00	7.26	8.82	10.08	18.51	21.70	26.10	32.32
	0:45:00	0.00	0.00	5.18	6.59	7.68	13.59	15.85	20.15	25.05
	0:50:00	0.00	0.00	3.80	5.09	5.70	10.84	12.59	15.52	19.37
	0:55:00	0.00	0.00	2.91	3.82	4.42	7.67	8.82	11.52	14.27
	1:00:00	0.00	0.00	2.56	3.32	3.97	5.71	6.51	8.93	11.06
	1:05:00	0.00	0.00	2.44	3.15	3.84	4.85	5.53	7.86	9.79
	1:10:00	0.00	0.00	2.05	3.08	3.79	4.04	4.58	5.75	7.07
	1:15:00	0.00	0.00	1.85	2.82	3.77	3.63	4.10	4.64	5.64
	1:20:00	0.00	0.00	1.73	2.55	3.41	3.05	3.43	3.41	4.11
	1:25:00	0.00	0.00	1.67	2.40	2.89	2.76	3.11	2.75	3.31
	1:30:00	0.00	0.00	1.62	2.31	2.59	2.34	2.63	2.34	2.80
	1:35:00	0.00	0.00	1.60	2.26	2.42	2.12	2.38	2.14	2.55
	1:40:00	0.00	0.00	1.60	1.92	2.31	1.99	2.24	2.07	2.46
	1:45:00	0.00	0.00	1.60	1.74	2.26	1.93	2.17	2.04	2.42
	1:50:00	0.00	0.00	1.60	1.63	2.24	1.90	2.13	2.04	2.42
	1:55:00	0.00	0.00	1.25	1.57	2.13	1.88	2.12	2.04	2.42
	2:00:00	0.00	0.00	1.05	1.44	1.87	1.88	2.12	2.04	2.42
	2:05:00	0.00	0.00	0.58	0.80	1.04	1.05	1.18	1.13	1.35
	2:10:00	0.00	0.00	0.31	0.44	0.57	0.59	0.66	0.63	0.75
	2:15:00	0.00	0.00	0.15	0.23	0.29	0.30	0.34	0.32	0.39
	2:20:00	0.00	0.00	0.06	0.11	0.13	0.15	0.16	0.16	0.18
	2:25:00	0.00	0.00	0.02	0.03	0.04	0.04	0.05	0.05	0.06
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: TAMLIN ROAD RV STORAGE - POND A

Facility Location & Jurisdiction: EL PASO COUNTY

User Input: Watershed Characteristics

Watershed Slope =	0.023	ft/ft
Watershed Length =	713	ft
Watershed Area =	9.56	acres
Watershed Imperviousness =	71.7%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent

Location for 1-hr Rainfall Depths (use dropdown): User Input

WQCV Treatment Method = Extended Detention

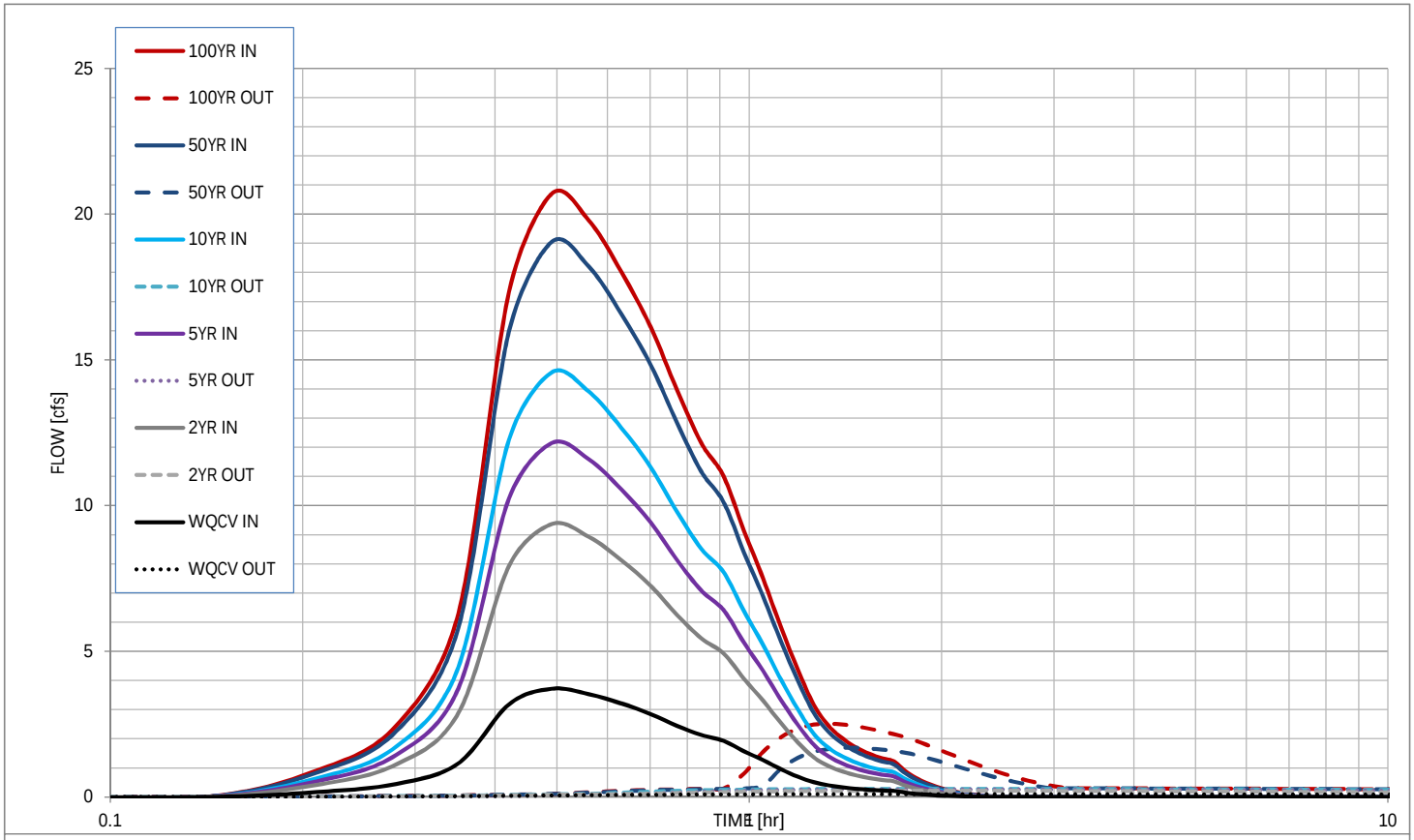
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	0	0.00	0.00
0.30	750	0.30	0.02
1.30	5,149	1.30	0.07
2.30	9,172	2.30	0.11
3.30	12,103	3.30	0.23
4.30	15,085	4.30	0.30
5.30	18,119	5.30	6.75
5.60	19,309	5.60	6.91

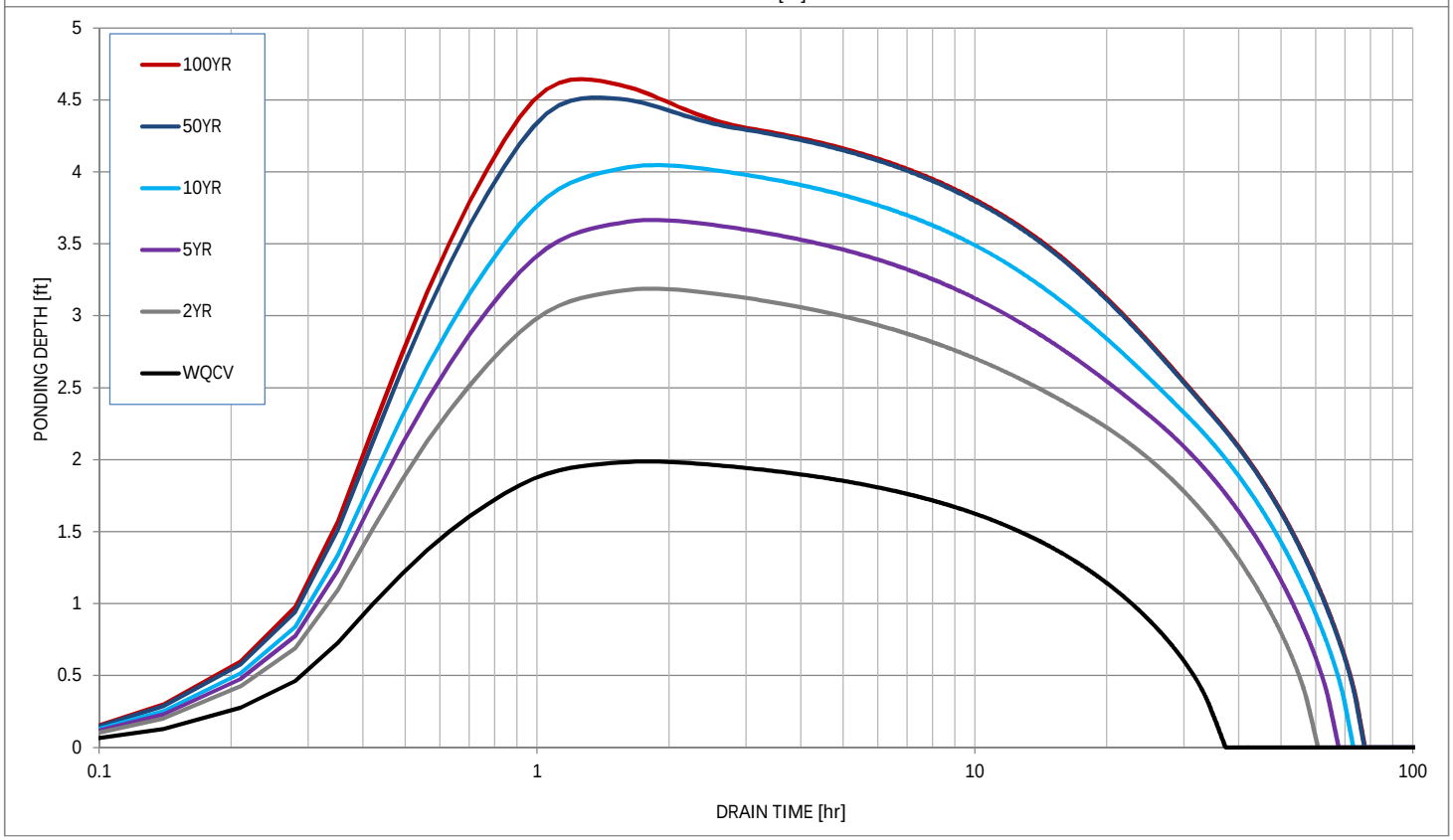
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	1.19	1.50	1.75	2.00	2.25	2.52	in
Calculated Runoff Volume =	0.225	0.760	0.916	1.088	1.339	1.571	acre-ft
OPTIONAL Override Runoff Volume =	0.19	0.47	0.62	0.74	0.97	1.06	acre-ft
Inflow Hydrograph Volume =	0.185	0.473	0.615	0.739	0.970	1.055	acre-ft
Time to Drain 97% of Inflow Volume =	32.7	52.8	58.4	62.8	65.4	64.9	hours
Time to Drain 99% of Inflow Volume =	34.7	56.5	62.8	67.7	71.2	71.0	hours
Maximum Ponding Depth =	1.99	3.19	3.67	4.05	4.52	4.64	ft
Maximum Ponded Area =	0.18	0.27	0.30	0.33	0.36	0.37	acres
Maximum Volume Stored =	0.173	0.447	0.584	0.703	0.866	0.913	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**RYAN DEGROOT**
Company:	**JR ENGINEERING**
Date:	**July 10, 2020**
Project:	**TAMLIN ROAD RV STORAGE**
Location:	**UNINC. EL PASO COUNTY**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a

I_a = 71.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)

i = 0.710

C) Contributing Watershed Area

Area = 9.560 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm

d_6 = 0.42 in

E) Design Concept
(Select EURV when also designing for flood control)

Choose One
- ○ Water Quality Capture Volume (WQCV)
- ◉ Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)

V_{DESIGN}= 0.223 ac-ft

G) For Watersheds Outside of the Denver Region,
Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43))$

$V_{DESIGN\ OTHER}$= 0.218 ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired)

$V_{DESIGN\ USER}$= ac-ft

I) Predominant Watershed NRCS Soil Group

Choose One
- ◉ A
- ○ B
- ○ C / D

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$

EURV = 0.863 ac-f t

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

L : W = 0.8 : 1 **INCREASE FLOW PATH FOR 2:1 RATIO**

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

Riprap rundowns down the side slopes of the podn at outfall locations and riprap pads extend into pond bottom.

Design Procedure Form: Extended Detention Basin (EDB)

Designer: RYAN DEGROOT
Company: JR ENGINEERING
Date: July 10, 2020
Project: TAMLIN ROAD RV STORAGE
Location: UNINC. EL PASO COUNTY

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.007 ac-ft

B) Actual Forebay Volume — V_F = 0.007 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 15.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 34.40 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.69 cfs

E) Forebay Discharge Design

Choose One
- ○ Berm With Pipe
- ◉ Wall with Rect. Notch
- ○ Wall with V-Notch Weir

(flow too small for berm w/ pipe)

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = in

G) Rectangular Notch Width — Calculated W_N = 4.8 in

6. Trickle Channel

A) Type of Trickle Channel

Choose One
- ◉ Concrete
- ○ Soft Bottom

F) Slope of Trickle Channel — S = 0.0100 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 21 sq ft

C) Outlet Type

Choose One
- ◉ Orifice Plate
- ○ Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 1.23 inches

E) Total Outlet Area — A_{ot} = 5.59 square inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: RYAN DEGROOT
Company: JR ENGINEERING
Date: July 10, 2020
Project: TAMLIN ROAD RV STORAGE
Location: UNINC. EL PASO COUNTY

8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 28.4 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 7.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 191 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*S.S. Well Screen with 60% Open Area*
Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 319 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 4.54 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 82.48 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches

Design Procedure Form: Extended Detention Basin (EDB)

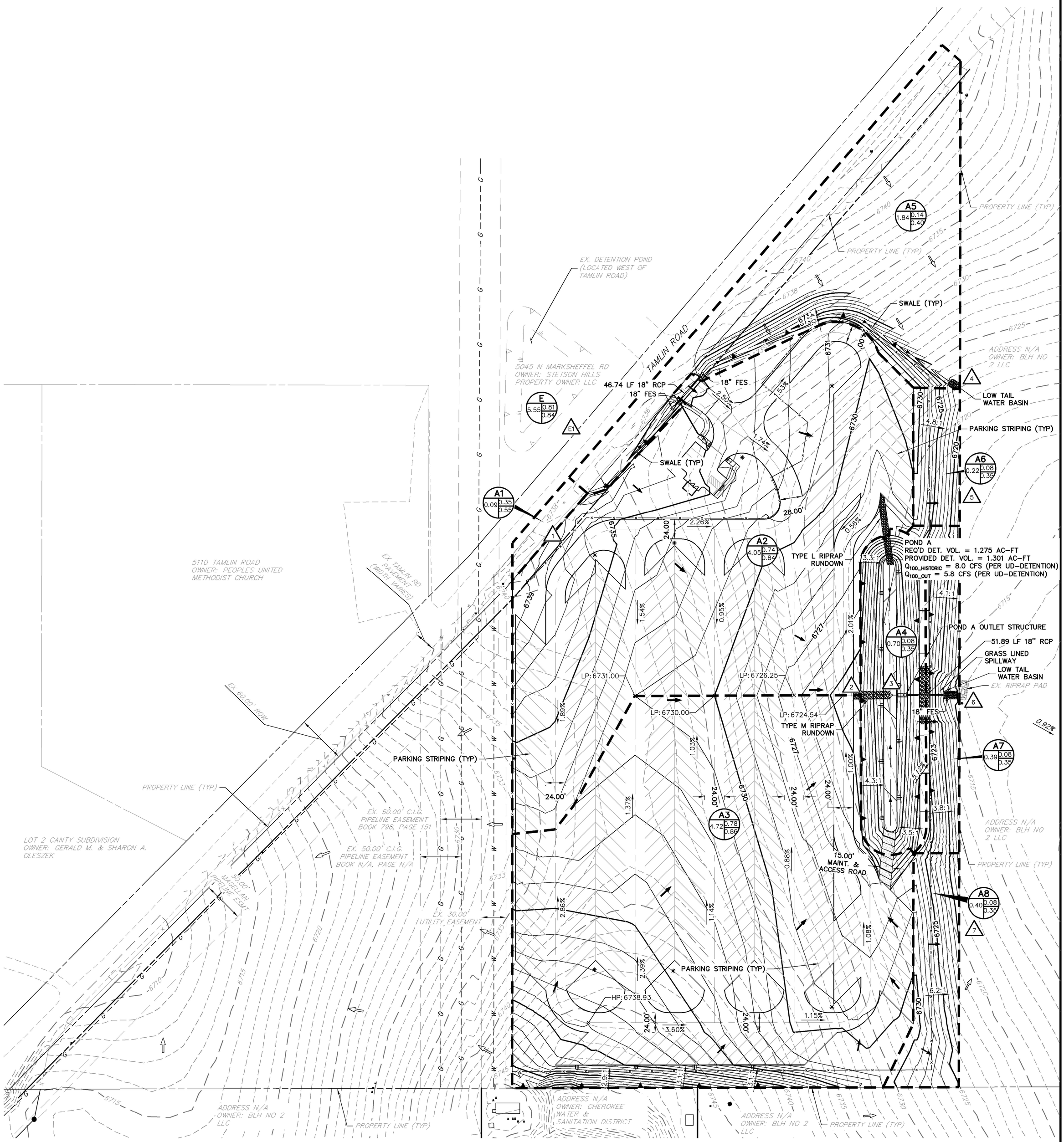
Designer: RYAN DEGROOT
Company: JR ENGINEERING
Date: July 10, 2020
Project: TAMLIN ROAD RV STORAGE
Location: UNINC. EL PASO COUNTY

10. Overflow Embankment	
A) Describe embankment protection for 100-year and greater overtopping:	24" Deep Type M Soil Riprap overflow weir w/ 1.36' total depth (design flow depth < 0.36') 60' crest width. 4:1 side slopes
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	4.00
11. Vegetation	Choose One: ○ Irrigated ◉ Not Irrigated
12. Access	
A) Describe Sediment Removal Procedures	Pond will be maintaned utilizing skid steer type equipment, trucks (when needed), and hand tools as needed.

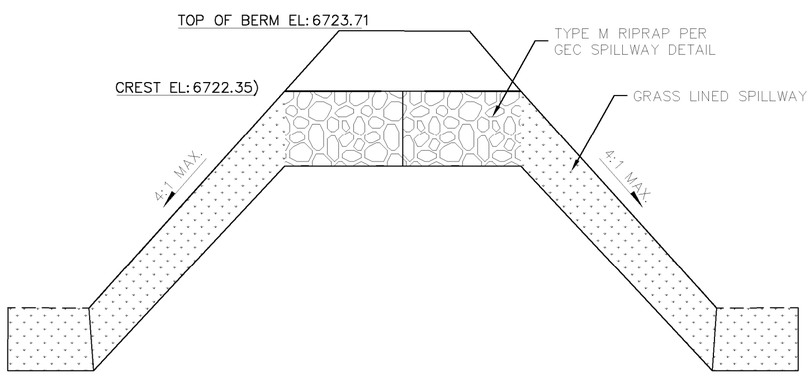
Notes:

Appendix F
Drainage Maps

TAMLIN ROAD RV & BOAT STORAGE
PROPOSED DRAINAGE MAP



ORIGINAL SCALE: 1" = 60'



POND SPILLWAY BERM SECTION
NTS

LEGEND

- BASIN DESIGNATION (I.D.: A = BASIN IDENTIFIER; B: C_5; C: C_{100})
- DESIGN POINT
- BASIN DELINEATION
- EXISTING INDEX CONTOURS (6100)
- EXISTING INTERMEDIATE CONTOURS
- PROPOSED INDEX CONTOURS (6100)
- PROPOSED INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION
- PROPOSED FLOW DIRECTION

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	0.09	33%	0.35	0.55	5.0	0.2	0.4
A2	4.05	74%	0.71	0.81	6.8	13.5	26.0
A3	4.72	81%	0.78	0.86	8.5	16.0	30.0
A4	0.70	0%	0.08	0.35	7.0	0.3	1.9
A5	1.84	9%	0.15	0.40	8.5	1.2	5.5
A6	0.22	0%	0.08	0.35	5.0	0.1	0.7
A7	0.39	0%	0.08	0.35	5.0	0.2	1.2
A8	0.40	0%	0.08	0.35	5.0	0.2	1.2
E	5.55	86%	0.79	0.84	n/a	n/a	5.6

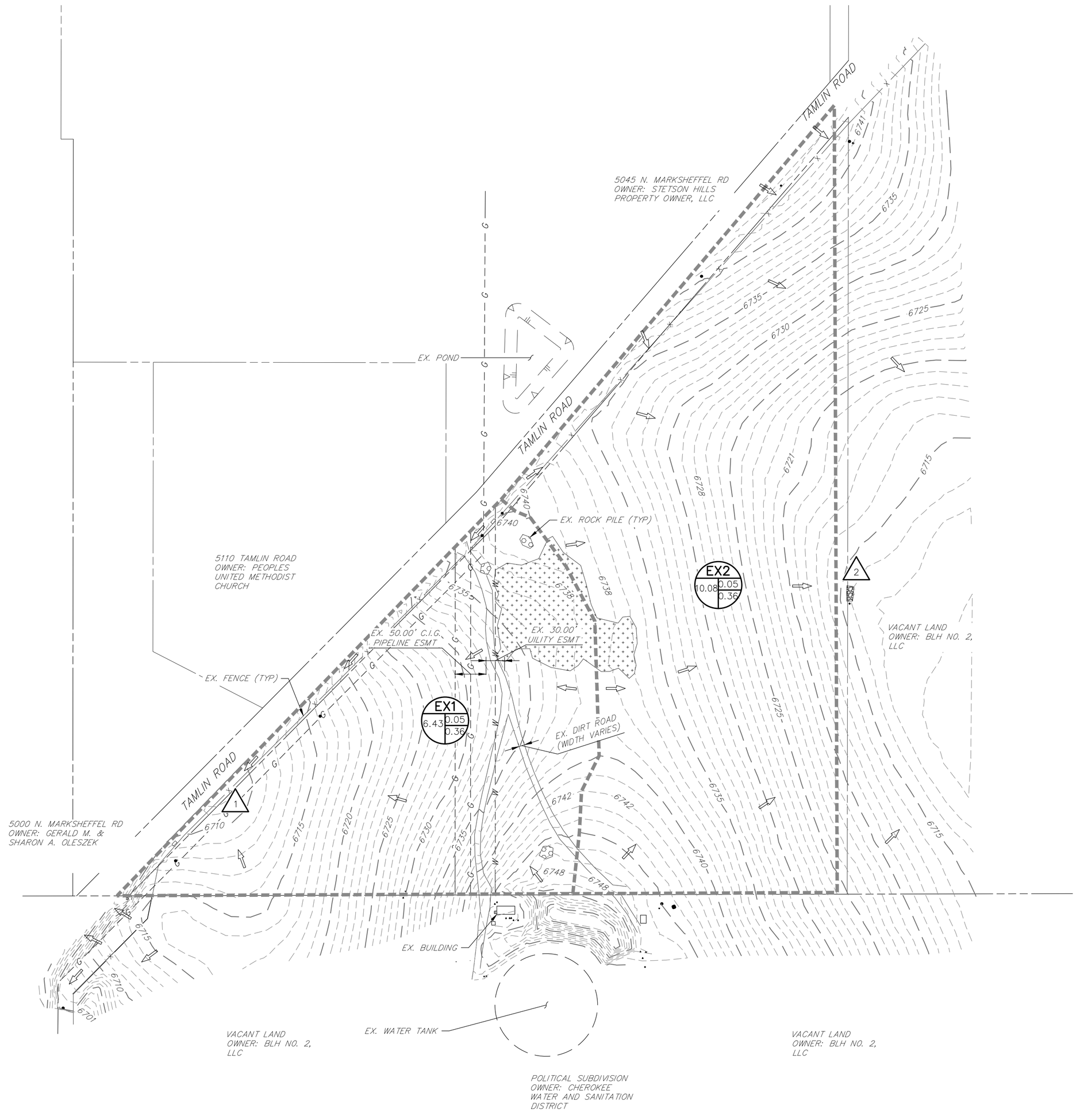
DESIGN POINT SUMMARY TABLE

DP#	Q_5 (cfs)	Q_{100} (cfs)
1	0.2	0.4
2	28.7	54.6
3	28.8	56.3
4	1.2	11.0
5	0.1	0.7
6	0.2	1.2
7	0.2	1.2
E1	n/a	5.6

TAMLIN ROAD RV & BOAT STORAGE
DRAINAGE MAP
25134.00
06/08/2020
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

TAMLIN ROAD RV & BOAT STORAGE
EXISTING DRAINAGE MAP



LEGEND

- I.D. (A: BASIN AREA; B: C_5; C: C_{100}) — BASIN DESIGNATION
- X — DESIGN POINT
- BASIN DELINEATION
- 6100 — EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 6100 — PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX1	6.43	2%	0.05	0.36	13.4	1.2	14.3
EX2	10.08	2%	0.05	0.36	15.4	1.8	21.2

DESIGN POINT SUMMARY TABLE

Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
1	1.2	14.3
2	1.8	21.2

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

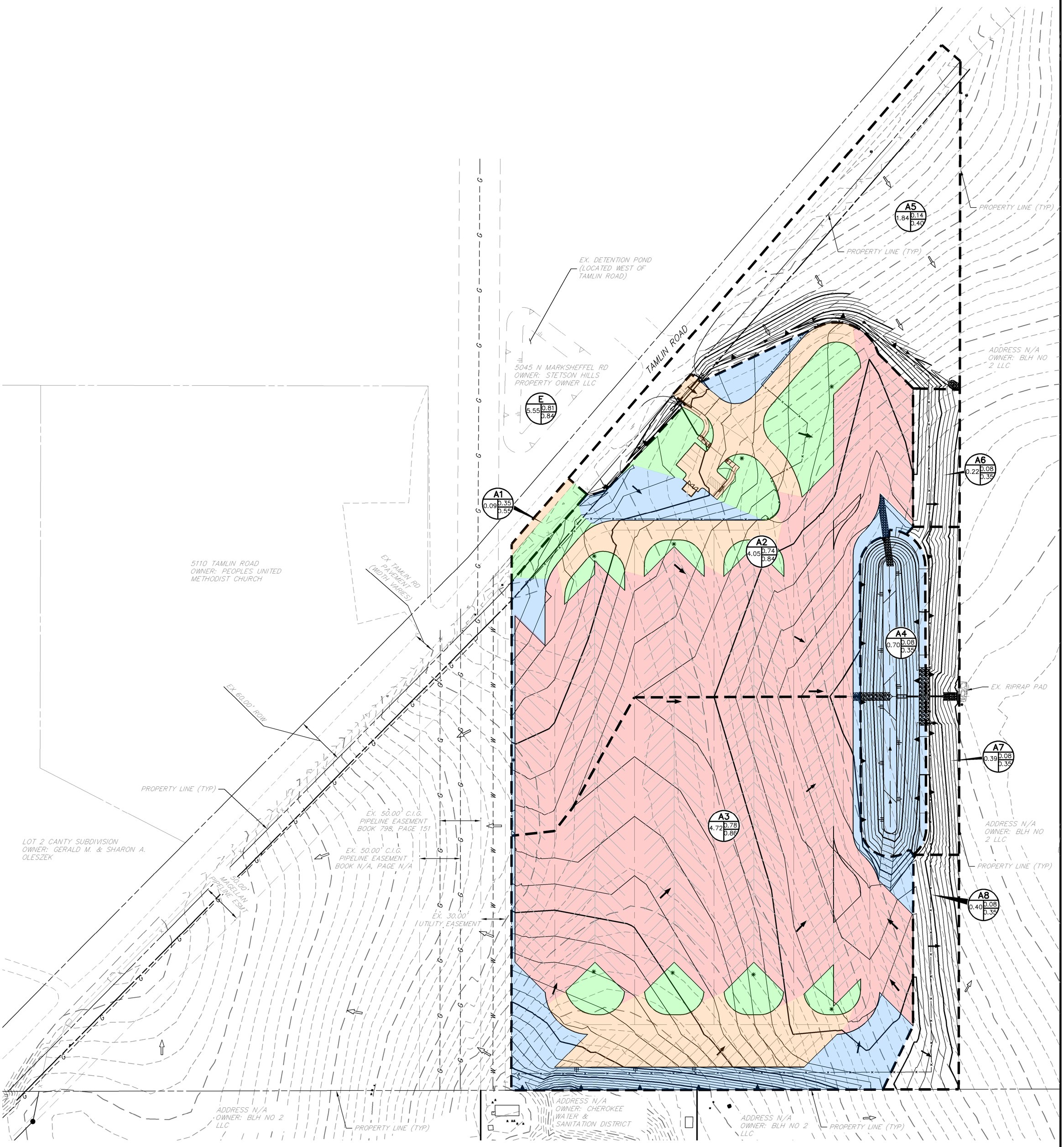
TAMLIN ROAD RV & BOAT
STORAGE
EX. DRAINAGE MAP
2513400
01/20/2020
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

TAMLIN ROAD RV & BOAT STORAGE

IRF MAP EXHIBIT



STORM WATER IRF LEGEND

DIRECTLY CONNECTED IMPERVIOUS AREA	
UNCONNECTED IMPERVIOUS AREA	
RECEIVING PERVIOUS AREA	
SEPARATE PERVIOUS AREA	

N

60 30 0 60 120

ORIGINAL SCALE: 1" = 60'

TAMLIN ROAD RV & BOAT
STORAGE
IRF MAP EXHIBIT
25134.00
06/08/2020
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303–740–9393 • Colorado Springs 719–593–2593
Fort Collins 970–491–9888 • www.jrengineering.com